SCIENTIFIC AMERICAN

A Weekly Review of Progress in

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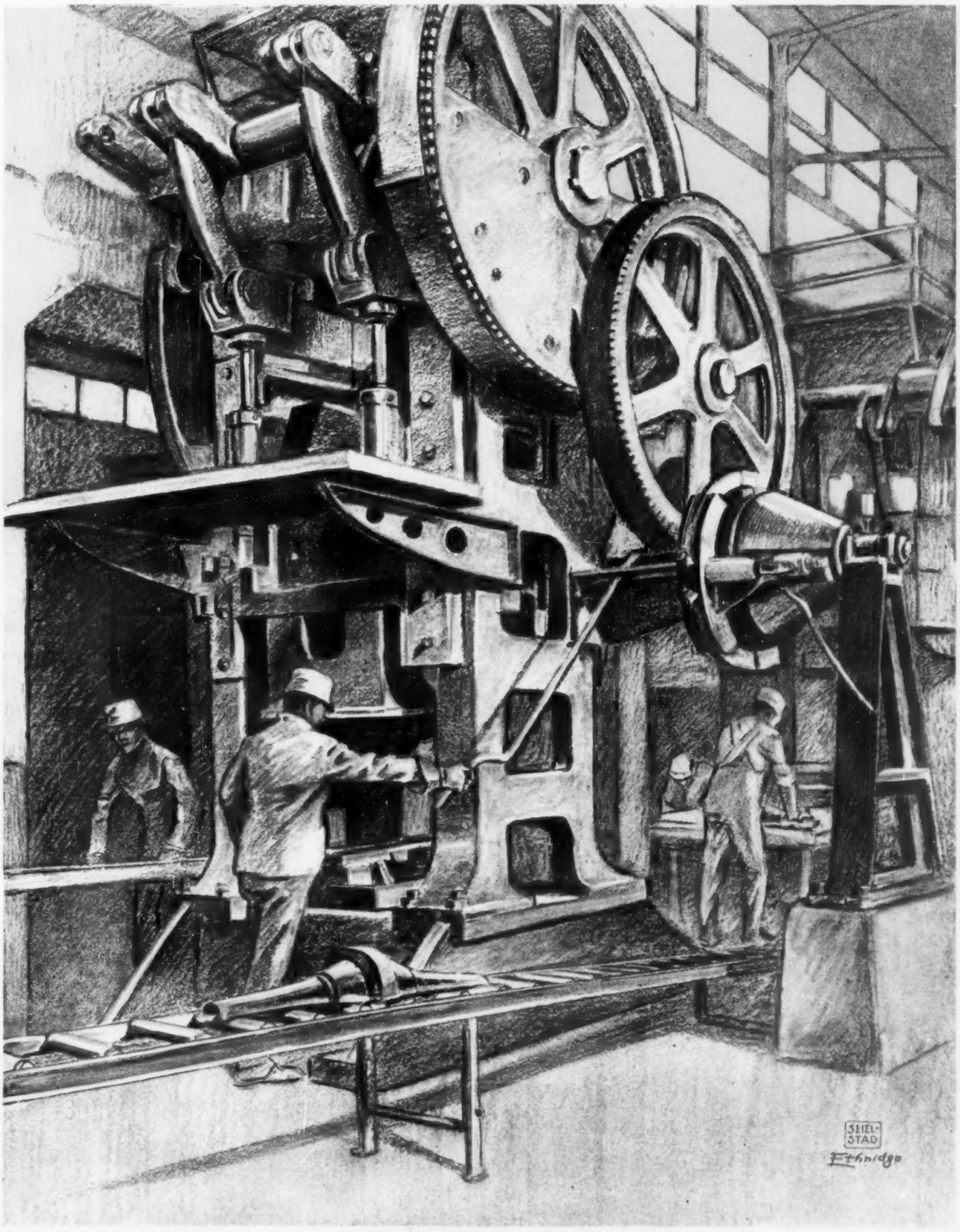

FORMING AUTOMOBILE PARTS WITH HUGE POWER-OPERATED PRESSES

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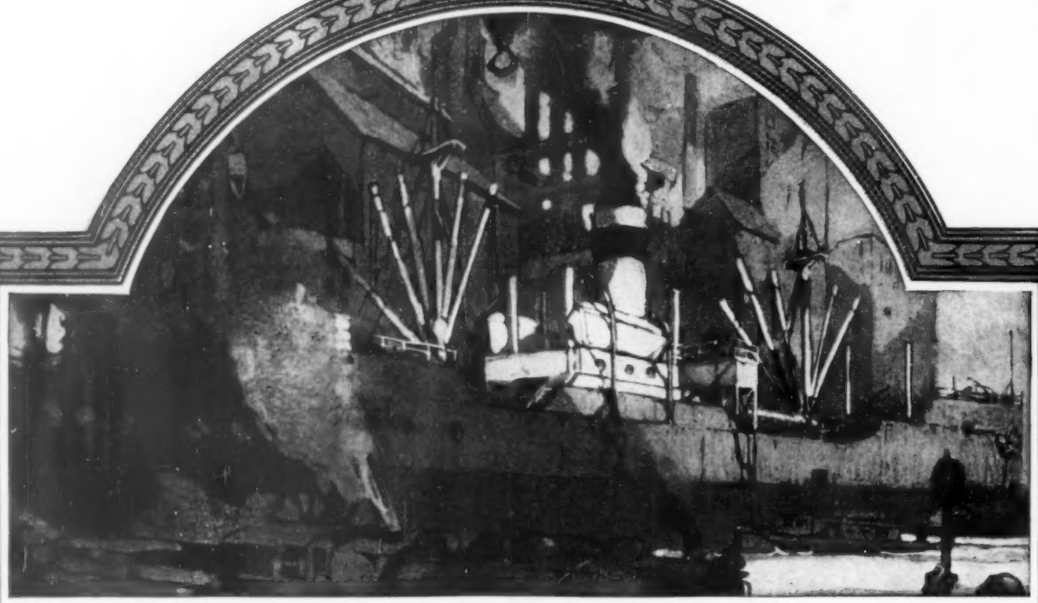

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United States Senator Cummins.

ASK any doughboy who was "over there" and he will tell you that American railroads are the best in the world.

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SEVENTY-FIFTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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Automobiles and People

EVERY state in the union has taken advantage of the revenue-producing possibilities of the automobile, requiring that all cars and trucks, and in many instances drivers and owners as well, pay a license fee. The total revenue thus obtained in the 48 states and the District of Columbia is slightly over 50 million dollars per year. The motorist who pays this bill may, however, derive consolation from the fact that practically the entire sum—all of it except a bare four millions, in fact—goes toward the maintenance of the roads over which he drives. In many states the law requires that the entire sum received from automobile license fees be thus devoted to the upkeep of the highways; while in many others there may be deducted only the actual expense of administering the license bureau, the balance then going to the road-work account.

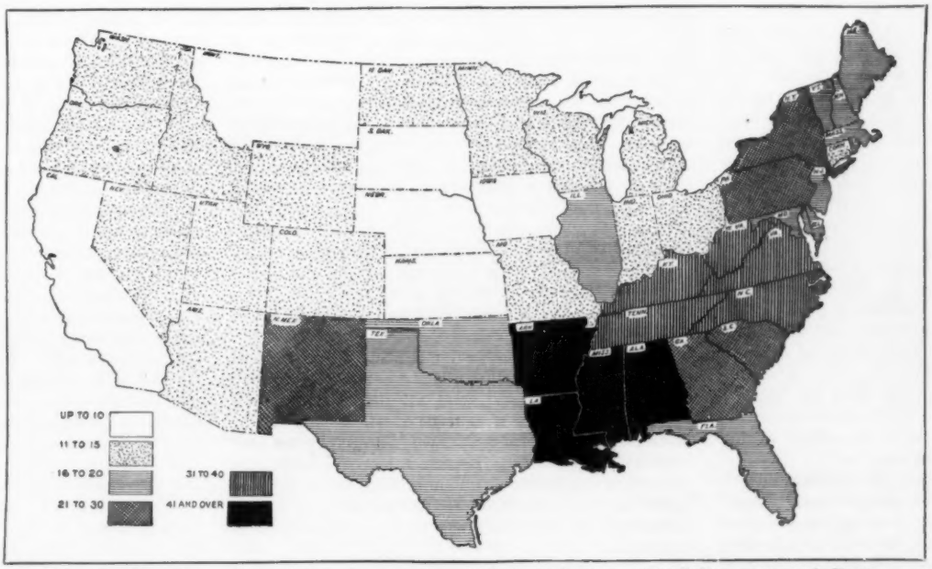
The motorist, however, accomplishes something more than this by the payment of his fees. He makes it possible for us to keep track of him and tell how numerous he is. It is not feasible to separate passenger cars from trucks in this connection, since 29 of the states make no distinction between these classes in the granting or recording of licenses; but since all states do issue and record licenses, we have here an excellent means for keeping track of the growth of the automobile habit.

In the absence of the data afforded by the registration figures, it is difficult to see just how we could estimate the extent to which automotive vehicles are used. There are of course the figures for annual production; but in the absence of figures for annual scrapping these would mean nothing—we could not separate old business from new, or say how much of the old business represented expansion, and how much actual replacement. One manufacturer, for instance, who turned out a few cars in 1904 and has been producing steadily ever since, was recently moved to inquire as to the present state of the dozen or so cars that represented his output in his first year of business. He actually found that several of these fifteen-year-old relics were still in service, and that several others had not disappeared entirely from the face of the earth. That sort of thing is an absolutely unknown element in general, however, and would checkmate any effort at intelligent estimate of the automobiling population and the number of cars in use, were it not for the very definite information which the registration figures throw upon these points.

Turning to the figures in question, we find that, as might be expected, New York leads with something like 485,000 vehicles. But if we had any idea that the other states would follow along in the approximate order of their population, we will be speedily disillusioned when we learn that California takes second place with 434,000 vehicles, 2,000 more than Pennsylvania, and leading seven other states that are credited with a greater population. This, of course, is really to be expected; there are a lot of things aside from mere bulk of population that go to determine the extent to which a state needs and can afford the automobile.

When we try to estimate the relative wealth of two or more communities, we usually express it in dollars per capita. But we have not reached the stage of general prosperity where we can express the number of automobiles per capita with anything other than a rather small fraction. So here we find it profitable to turn the thing around, and instead of finding the number of cars per person, find the number of persons per car. We must then note that, instead of showing the largest figure, the states where the automobile is most plentiful in proportion to the population will show the smallest.

With this preliminary consideration we may turn to the map on which we have diagrammed the results of our survey of the automobile registration figures. It will be recalled that the medical authorities are in the habit of issuing similar maps showing how states and counties have succeeded in combatting the ravages of some disease or pest; and that these maps usually indicate in a glorious white the regions that have made the best showing, and dress in mournful black those that stand at the bottom of the efficiency list. We have borrowed this idea; and we have assumed—what everybody may not be ready to admit offhand—that a dense distribution of motors is to the credit of a state, and therefore to be indicated by white, while progressive stages of motor scarcity are to be shown by progressive shades of black.



Map showing the number of persons per motor vehicle in each state. The lighter patterns indicate the heavier distribution of cars

We find, then, that the banner is to be awarded to California, with her perpetual summer, her tourist industry, and her wonderful roads; and to the great farming states of the west central region—Iowa, Kansas, Nebraska, South Dakota. Montana also slips into the first grade of states having better than one motor car for each ten persons; and the rest of the west, northwest and Pacific states fall unanimously in the second category, with enough cars to be distributed on a basis of 11 to 15 persons per car.

In other words, the entire country west of the Mississippi, save for the southwestern states, has more than one car for each 15 people; and as the map shows, there are but five states east of the big river that can equal this showing. The reason for this is obvious; the western states have the mileage, and lack the railroads; or where they have a fair share of railroads, as in Iowa, their agricultural interests are so heavy that a vast number of automotive vehicles is necessary to haul the crops and transact the rest of the multiform business about the farm.

Wisconsin, it seems, would account for its heavy motor car investment on the same grounds as Iowa; while Missouri, Ohio, Indiana and Michigan would probably plead that their combination of large cities and agricultural regions was of the sort to call for large numbers of cars and trucks. Connecticut doubtless outstrips its eastern neighbors because it is at once a community of commuters, of summer vacationists, and of big manufacturers. The southwestern states, which so far as their geography is concerned might be expected to fall in the 11-15 class, are tied up to a single crop in such a way that their general prosperity is not what it might be; while New Mexico's unfavorable showing beside its neighbor Arizona is probably attributable to the fact that it has less farming and more mining—the latter industry being served usually by railroad spurs. Also it is farther from California.

In the third class of states, with 16 to 20 persons per motor, we find Texas and Oklahoma, which, aided by their oil fields, are emancipating themselves more rapidly from the thrall of cotton than the true south, while they have greater distances to conquer; Florida with its huge winter tourist and vacation industry; and the states of the north Atlantic seaboard. It is not at first glance clear why all New England should outstrip New York, or why New Jersey, Delaware and Maryland should pass Pennsylvania; but the answer is doubtless to be found in a consideration of the heavy percentage of poverty among the New York and Pennsylvania urban population and the heavier expense of owning a car in the big cities. It is in this 16-20 group that the average for the entire country falls; for with something above 100,000,000 population, and almost 6,400,000 motor vehicles, we get a quotient of aproximately 16 persons per motor.

It seems as though we might almost forego the two groups into which we have divided the states that have less than one automobile for each 30 persons, and put them all in the same category. Georgia and South Carolina would then go in the class with New York and Pennsylvania, with the rest of the solid South making up the tail-end group. But after all, when we separate these states as we have done, the solid black and the black with white trimmings seem to correspond very well with the states that have not, and the states that have, made a good start in freeing themselves from the bondage of a single staple product. For this lesson if for no other reason it would be worth while to make the distinction that we have made.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Our Navy First Officially to Propose Reduction of Armaments

IT is to the abiding credit of the Navy of the United States that it was the first governmental institution to make a definite proposal for the reduction of naval armaments. This proposal was incorporated in that section of the naval bill for 1916, which authorized the first three-year program which is now practically under construction. It is of such historical importance, and, we have faith to believe, will be so greatly effective in keeping future naval appropriations within reasonable bounds, that we quote the words of the text of the bill:

"It is hereby declared to be the policy of the United States to adjust and settle its international disputes through mediation and arbitration, to the end that war may be honorably avoided. It looks with apprehension and disfavor upon a general increase of armament throughout the world, but it realizes that no single nation can disarm, and that without a common agreement upon the subject every considerable power must maintain a relative standing in military strength. . . . If at any time before the construction authorized by this Act shall have been contracted for, there shall have been established, with the coöperation of the United States of America, an international tribunal or tribunals competent to secure peaceful determinations of all international disputes, and which shall render unnecessary the maintenance of competitive armaments, then, and in that case, such naval expenditures as may be inconsistent with the engagements made in the establishment of such tribunal or tribunals, may be suspended when so ordered by the President of the United States."

It is a matter of history that in drawing up the terms of the Peace Treaty and with the hearty coöperation of our Allies, an article was included calling for the establishment of such a tribunal as had been definitely proposed by our Navy Department. It is a matter of history also that our European Allies have shown their good faith and earnest purpose to follow the lead of our Navy, by ceasing all capital ship construction and making drastic all-around reductions in their naval forces. This they have done without even waiting for the formation of the disarmament tribunal.

Now all of this should be very gratifying to our Navy Department, as showing that, in calling for reduction of armaments, it had struck a keynote which found a sympathetic response among the other great nations of the world. It is true that the Treaty as a whole has been repudiated. This was done, mainly through the violent opposition of a certain group of men in the Senate, whose leader has shown very clearly what they wished to do, and what they have indeed done, by his ever memorable utterance: "The Treaty is dead."

Though the Treaty may be politically dead, it is certain that the fine purpose which lay behind it was never more alive in the hearts of the American people than at the present writing. Moreover, since the European navies have made such a quick and voluntary response to the call of our Navy for disarmament, the people of the United States cannot be blamed if they look to see our Navy give, in its turn, a sympathetic response to this spirit of coöperation.

Consequently, they will learn with much astonishment that, in its recommendations recently submitted to Secretary Daniels for a naval building program for 1921, instead of acknowledging the facts as to naval reduction by our Allies, the General Board recommends yet another building program, all of which, it states, can be laid down during 1921. This program calls for two battleships, one battle-cruiser, ten scout cruisers, five flotilla leaders, six submarines, two airplane carriers, one destroyer tender, one submarine tender and $27,000,000 for aircraft construction. So that in addition to the eighteen battleships already authorized, we are to add three more capital ships, each presumably of 40,000 to 45,000 tons displacement, and twenty-five other warships. This program will mean, exclusive of the $27,000,000 for aircraft construction, the placing upon the shoulders of the country of an additional burden of $210,000,000.

"But fighting men," says Mr. Daniels in his recent report, "ready to surrender their lives for their country, and joyously, are the first to welcome sound measures to safely reduce armament and settle international differences in the forum of reason rather than in the conflict of battle." Evidently, the General Board of the Navy is in no such pacific mood as the Secretary for if, after our only possible future opponents have responded by reducing their armaments, the General Board continues to urge that the United States should increase its own armaments, it is evident that these gentlemen are in entire disagreement with the Secretary, with the President of the United States, with the vast majority of the people of the United States, and with those allies of ours who, with such evident good faith, have responded to the call of our Navy Department for disarmament.

But what in the world does the General Board expect to do with these additional ships when it has them? The Navy is not able to man the ships that it now has, and both officers and men are leaving the service at a rate which is causing, or should be causing, the Navy Department the most profound concern. Both officers and men are importuning Congress to give them an increase in pay to enable them to live merely with decency. But how can Congress be expected to grant increased pay appropriations, while the senior officers of the Navy are urging that we build in 1920 and 1921 nearly half a billion dollars' worth of new ships?

The Secretary of the Navy has made a most worthy effort through the resolution above quoted to initiate a reasonable disarmament, and all honor should now be given to him, as it will be given to him in the future, for this movement. We sincerely trust that when this preposterous request for the authorization of another two hundred million dollars' worth of ships comes up for debate before the House and Senate committees, the Secretary will set his face unalterably against it.

One Thing at a Time

ALTHOUGH we have recently completed a barge canal and built it along the lines of the very best current engineering practice, spending on the effort $150,000,000 from the State Treasury, there is already under serious discussion, a project for building a ship canal to do the very work for which the State Barge Canal was built.

If the traffic between the Great Lakes and the Atlantic can best be carried by a ship canal, then there is no need for a barge canal, and our magnificent waterway, the most important inland canal in the world, is a veritable "white elephant." But the Barge Canal is no "white elephant." On the contrary, it will prove to be the most valuable single asset possessed by the State and available for use by any of its citizens. It is true that the Barge Canal is not as yet handling the amount of freight which it could carry, but there are many temporary reasons for this condition, among which may be mentioned governmental and railroad interference and the high cost of barge construction. The fundamental trouble with the canal at the present time is that there is a great shortage of vessels in which to move commodities.

By way of visualizing this point, State Engineer Frank M. Williams, speaking at the annual convention of the New York State Waterways Association, made an estimate of the number of barges that would be required to carry the *minimum* of freight for which the canal was designed. Assuming that a trip can be made from Buffalo to New York, a cargo unloaded and a new cargo taken on, and the return trip made from New York to Buffalo, all in three weeks' time, and assuming also that each unit or fleet consists of four barges carrying altogether 2,000 tons—there would be needed to handle 10,000,000 tons of through freight in the eight months during which navigation is open, a total of from 1,000 to 1,500 barges. The total of government-built barges, those of the Standard Oil and General Electric Companies and other business concerns, is equivalent to about 200 barges. From this it is evident that the canal is more than 800 barges short of the number required to load the Erie Barge Canal even to its *minimum* capacity. It is the belief of the State Engineer that the canal can accommodate upward of 2,000 full-size barges.

Now it is a fact that the people of this State and of the country generally do not realize what a magnificent property exists in this 12-foot waterway from the Great Lakes to the sea, and the possibilities of service which it will reveal when it has been fully equipped. One trouble is that the public is so accustomed to shipping by rail that it does not know how to ship by water. There is need of an educational movement to prove to the public the advantages of canal shipment, and they should be instructed about the relative cost of water and rail shipment. Here is a work which the New York State Waterways Association should take in hand in a very thorough and earnest manner. It is the purpose of the SCIENTIFIC AMERICAN to publish, beginning with the first issue of the new year, a series of articles on the State Barge Canal which will lay before the public in full detail the whole situation. The opening chapters of the series will be written by Edward L. Walsh, Superintendent of Public Works, and by State Engineer Frank M. Williams.

We regret to note that there has recently been renewed in Congres a discussion looking to the revival of the old ship-canal project. One plan contemplates the improvement of the St. Lawrence River, and the other calls for a route within the limits of the State of New York, reaching the seaboard at this city. The main objection to the St. Lawrence route is that it takes the control of such a connecting channel out of the hands of the United States. Furthermore, the channel down the St. Lawrence is hazardous; Halifax is closed during four months of the year by ice; there would be great disorganization of shipping during the four closed months, if Halifax or Montreal were to become a great trans-shipping center; and, lastly, the coast along eastern Canada is foggy and extremely dangerous to navigation.

In regard to the freight problem, the question of loading would be entirely against Montreal and in favor of New York, for, in the past, the entire tonnage into Montreal has not amounted to fifty per cent of all the tonnage out of Montreal. In other words, as stated by State Engineer Williams, Montreal and its hinterland does not take enough cargo to more than half fill all the ships which come to the port to load Canadian products out. The port of New York, on the other hand, has usually been able to assure full cargoes both ways—a condition due to the greater development and purchasing power of the more developed hinterland of the United States.

Let us do one thing at a time. The obvious thing just now is to push through the construction of suitable local docks and terminals, and to construct an adequate fleet of barges. Personally, we have no doubt whatsoever that with a fleet of first-class barges available and with terminals provided with the most up-to-date freight handling facilities, and with judicious management by an engineer whose tenure of office should be limited only by his failure to produce results, the Barge Canal would prove to be one of the most successful engineering and economic enterprises of the century.

Electricity

Letting the Audience See Themselves.—Somebody in England has realized that the audience is half the fun in a theater, and is planning to have a mirror drop curtain so that one can study the dress circle from the orchestra without turning one's head. The curtain will be raised and lowered by electric power, continues the *Journal of Electricity*, and will have air cushions to prevent jarring when the curtain touches the stage.

Trouble-Making Spiders.—Spiders are responsible for quite a number of troubles on the telegraph lines in Argentine Republic and Brazil. The ground spider spins a heavy web which the wind wraps around the wires in great masses, and when these become damp, short circuits are formed. Trouble men are obliged to folow the wires across the country and remove the webs. Of course, the spiders that grow in South America are not the small and harmless insects to which we are accustomed.

Dealing with Long Transmission Lines from the practical point of view, M. P. Bunet, writing in a recent issue of *Revue Generale de l'Electricite*, compares alternating currents with direct series current. He concludes: "The transmission of 100,000 kw. to 200,000 kw., a distance of 500 kilometers (300 miles) is possible under good conditions by employing alternating current with the material that is available today or will be tomorrow. It would probably be possible also to accomplish the result with direct series current on condition that important improvements in the machines were realized, but this seems at present much further away." The author pleads for the employment of French engineers, constructors and promoters in all such enterprises, holding that France has plenty of able technicians to insure success.

Contacts and Contact Material.—Writing in the London *Electrician*, H. Von Fleischbein, states that platinum is the best metal for contact material, since it never oxidizes under chemical or electrical action. It is, moreover, sufficiently hard and has a very high melting point. Yet there are a good many complaints about the uncertainty of contacts using platinum. The author suggests using a sharp-pointed lower electrode, when one is above the other, in order to avoid the collection of dust and dirt. Sparking should also be prevented by the use of a suitable resistance or capacity in parallel with the spark. Considerable attention has lately been given to the use of tungsten as a possible substitute for platinum. Tungsten is very brittle at ordinary temperatures but is capable of being worked under the hammer at a red heat. At ordinary temperatures it is not attacked by either acids or gases. The author relates a favorable experience with vibrating contacts of tungsten carrying considerable current and also describes methods of welding these contacts to their terminals.

The Sun as a Magnet.—An instance of the far-extending range of modern speculation on physical subjects is afforded by a paper recently read at the British Association meeting at Bournemouth by Sir Joseph Larmor, who discussed the circumstances under which a rotating body, such as the sun, could become a magnet. These possibilities were indicated: (1) Surface phenomena on the sun suggest the existence of a residual internal circulation, inducing an electric current flowing through a conducting path around the solar axis: this would produce a magnetic effect. (2) Conceivably, the force of gravitation, or centrifugal force, can excite electrical polarization. (3) Crystals possess permanent intrinsic electric polarization, and one of the size of the earth would presumably produce an enormous electrical field; such a crystalline body moving with high speed through the ether might be expected to produce a magnetic field. It is easy, however, to adduce evidence against (2) and (3). The extraordinary feature of the earth's magnetic field is its great and rapid changes. Yet the absolute fixity of length of the astronomical day indicates extreme stability of the day as regards material structure. But, conceivably, considerations of the type (1), which appear reasonable for the case of the sun, would account for magnetic change, gradual or sudden, on the earth.

Astronomy

A Long Meteor Flight.—Numerous observations of the brilliant meteor seen in the early evening of October 21, 1919, show that it had the long horizontal flight of 335 miles from over a point 20 miles northeast of York, England, to 30 miles southwest of St. Valery, France. It traveled at a speed of about 33 miles a second and its average altitude was 74 miles. Its radiant point and speed agree nearly with those computed by Prof. A. S. Herschel for the meteors from the comet of 1739.

Tests of the World's Largest Telescope.—At the last meeting of the American Astronomical Society Prof. Hale reported some preliminary results of comparative tests of the new 100-inch reflector at Mt. Wilson and the 60-inch reflector at the same observatory. On August 13 last numerous spectograms of the star Epsilon Andromedæ were made with both telescopes. The mean ratio of the exposure-times required to give the same intensities and photographic resolution with the two instruments varied from 4.5 for wave-length 4,000 to 3.3 for wave-length 4,500, in favor, of course, of the larger telescope. The superiority of the new instrument is well shown by the experience of Dr. Merrill in spectographic studies of stars of Class Md., of which about 200 brighter than the 9th magnitude at maximum are known in the latitudes accessible to the Mt. Wilson instruments. For most of these stars exposures of five hours or more are required with the 60-inch to yield a measurable absorption spectrum. In fact, so few can be effectively observed for both dark and bright lines that it would hardly be advisable to enter upon an extensive study of these objects with the smaller telescope. The greater light-gathering power of the 100-inch, says Prof. Hale, makes such a study perfectly feasible. Good photographs of the absorption spectra of some of them have been obtained with exposures of two hours or less. Dr. Shapley, in studying star clusters with the 100-inch, finds a gain of about one magnitude. Photographs of the moon have not yet been made under ideal conditions with the new telescope, but Prof. Hale states that the extraordinarily minute structure of lunar details that he has observed visually with this instrument indicate that it is exceptionally well adapted for lunar photography.

Number and Distances of Globular Clusters.—A paper by Harlow and Martha Shapley reports that 17 additions have recently been made to the list of globular clusters, 69 in number, recognized up to a year ago. Special efforts have been made to examine with the 60-inch Mt. Wilson reflector the suspected and doubtful cases north of declination 30 deg. that had not been admitted to earlier lists. Some observations have also been obtained from other sources. Exposures of several hours were necessary in some cases to test for globularity. Frequently star systems that shorter exposures had shown with some definiteness to be open proved upon more persistent observation to be globular. At present there is hardly another object, north of decl.-30 at least, that is suspected with good reason of being a globular cluster. The authors record the galactic latitude and longitude of each of the 17 clusters and also give estimates of their distances, based chiefly upon diameters. Practically all these additional systems are more distant than 30,000 parsecs (100,000 light-years), thereby confirming an earlier surmise of the writers as to the completeness of the survey of globular clusters within that distance of the sun. The cluster N.G.C. 7006, with adopted distance of 67,000 parsecs, still holds its place as the most remote sidereal object of definitely estimated distance. Perhaps the most striking result of this special survey, say the writers, is the evidence that every faint, little condensed cluster in galactic latitude higher than 15 or 20 deg. is really globular, though short exposures and visual observations had in several cases heretofore recorded few stars. On the other hand, the similar faint clusters along the galactic equator, without exception, are open groups with no condensed background of faint stars appearing on long exposures. Thus the evidence grows continually stronger that open and globular clusters occupy regions of space that are mutually exclusive.

Industrial Efficiency

Chinese Wearing Apparel.—The Chinese wear clothes which differ so radically in style from the clothes of other nations that the American manufacturer of wearing apparel will find the Chinese market for his goods limited mostly to foreigners and to the comparatively few Chinese who have adopted foreign dress. Chinese clothes are largely made at home, being merely basted together, and they are ripped apart each time they are washed.

British South Africa.—During the past four years industrial development in South Africa has unquestionably been very rapid. The Union was thrown upon its own resources for many goods which formerly were imported from abroad, and this resulted in a considerable amount of industrial activity under conditions which have amounted in many cases, at least, to the most extreme forms of protection, including the exclusion of competing products from overseas.

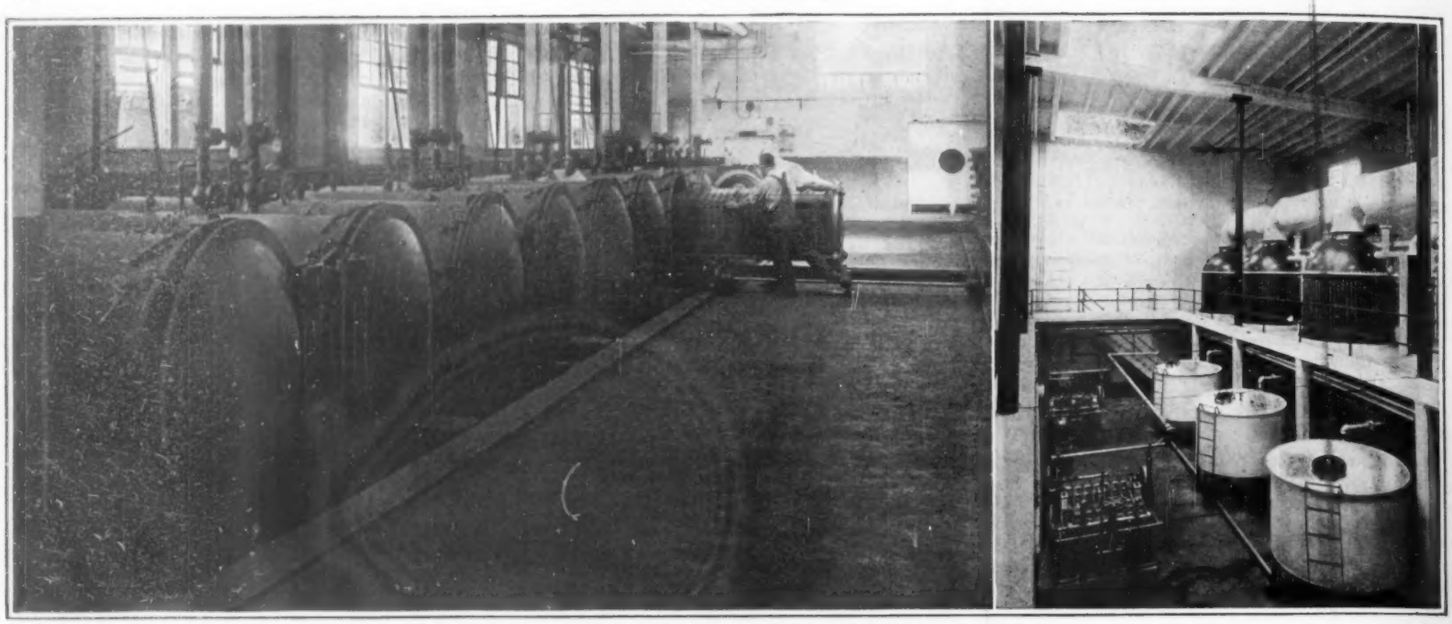
German Dyes for Great Britain.—The British Board of Trade has just given notice to consumers of dyestuffs that the first instalment of colors, which Germany has to furnish under the reparation clauses of the Peace Treaty will shortly arrive in the United Kingdom, and will be followed at intervals with additional quantities. Distribution will be made as soon as possible after each consignment is received. The basis for distribution will be the normal probable requirements for the next six months of the members of the Color Users' Association and the National Federation of Paint, Color and Varnish Manufacturers.

The City of Lyon is now busily engaged in applying to peace purposes the vast organizations built up in that center during the war. Owing to its geographical situation, as well as its industrial history, this French city became during the war the most important arsenal in France. Its chemical and metallurgical industries, which enjoyed an exceptional reputation before the war, have been considerably developed during these last five years, and when they are reorganized for operations under peace conditions they will undoubtedly be the most important establishments of their kind in France.

Priestman Plan of Fixing Wages.—Details of a scheme adopted by a firm of machinery manufacturers which has increased its average output by 50 per cent have been made public by the Higher Production Council of London, England. The Priestman scheme, as it is called, is based on the principle that a number of men can produce by ordinary effort a certain amount, known as the "standard," but by increased individual effort this can be exceeded. Every employee receives a percentage on his wages for all output in excess of the standard. Thus, if the output is increased by 50 per cent, a fitter earning $12.28 a week, would receive $18.42.

France's Reconstruction Task.—The following facts regarding the magnitude of the reconstruction task confronting the French Minister of the Liberated Regions were given out by M. Labbe, Director General of Technical Services. Building work alone would require 22,000,000 tons of material and the labor of 700,000 people for one year; 100,000 houses are to be entirely rebuilt, requiring 5,000,000,000 bricks, 3,000,000 cubic meters of sand, 1,000,000 tons of lime, 13,000,000 square meters of tiles, and 3,000,000 cubic meters of wood. Reconstruction of highways and railroads would require 3,000,000 tons of materials and the labor of 15,000 men for one year. An addition of 20,000 trains and 5,000 trucks would be required.

Finland and Lumber.—Finland, cut off from its normal markets for lumber in Russia, found itself at the beginning of the current year with stock amounting to 750,000 to 1,000,000 standards (standard = 165 cubic feet). Of this stock 500,000 standards have been sold, principally to England, Germany, and the Netherlands, but owing to lack of tonnage and high cost of transportation, the movement of this lumber is very slow. It is estimated that only 250,000 to 300,000 standards can be shipped during the current year. Cut off from markets in Russia and Germany, Finland has been forced to find a new market for its sulphate and sulphite pulp. This market has been developed in the United States and in South America.



The utilization of skim milk in the manufacture of the condensed article

Left: The sterilizing machines in a condensed milk factory. *Right*: Tanks, evaporating pans and emulsifying machinery which combine vegetable fats with the skim milk to give a high grade condensed milk.

Food versus Feed

The Benefits to be Derived from Eating Skim Milk Instead of Giving It to the Barnyard Stock

By Arthur L. Dahl

DURING the war all food producers were urged to increase production in the United States to meet the needs of the world. We were also taught that conservation of food supplies was as vital and valuable as growing them. Certain commodities, if properly stored and used, were ample to meet all needs, but if wasteful practices were indulged in, a shortage would occur. The farmer who raised 50 bushels of wheat to the acre, but who allowed half of it to be lost through improper handling, performed no greater service than his neighbor who raised only 25 bushels to the acre but conserved and saved all of it. It is the proportion of food supplies used as against the proportion produced that counts.

Such a situation confronts this country now in the matter of its milk supply. Everywhere the price of milk is increasing, and one of the reasons given for the increase in price is the matter of supply. In some sections there are not enough dairy cows to supply the demands for fresh milk, while in the large dairy districts the demand is for the butter-fat alone. By reason of this demand wasteful practices have been permitted to become prevalent, and in spite of the fact that milk is one of the most valuable foods in the world, and contains practically all of the elements needed to develop and sustain the human body, the greater proportion of it is either wasted or else used for stock-feeding, where but a fraction of its food values are utilized.

Under the practice prevailing in all dairying communities fresh milk is sold for its butter-fat content, that is, the only standard of value for milk is the amount of butter-fat which can be taken from it. Whole milk, just as it comes from the cow, is composed of 5% carbohydrates, or energy-making elements; 3.3% protein or muscle-building elements; 4% butter-fat, or heat and energy-building elements, and .7% mineral salts, which build bone and teeth, and help in the digestive processes. The balance is water. In addition to these there are certain elements which chemists have not yet been able to analyze, but which are said to be particularly important as affecting the growth of children, and found to a greater extent in milk than in any other article of the diet. These elements are known as vitamines, sometimes designated as "Fat Soluble A" and "Water Soluble B." Accordingly, whole milk contains the solids necessary to existence in just the right proportions as required by the body, and in addition contains the valuable vitamines, or growth-producing elements, and is the most complete and perfectly balanced food of any of the natural foods we have.

According to the Department of Agriculture a little over 43 per cent of the milk production of the United States goes direct to the consumer in the form of whole milk; 4.3 per cent of whole milk is fed to calves; 3 per cent is condensed or evaporated; 41 per cent is used for making butter, and the rest used for making cheese, ice cream, etc. Of the 41 per cent used in butter-making, 37 per cent remains in the form of skim milk, after the cream is removed. The government report on the production of milk for the year 1917 shows that there was produced in the United States, 84,611,350,000 pounds of whole milk, of which amount 41 per cent or 34,690,553,500 pounds was devoted to butter-making. Only the cream, of course, went into the butter churns, and as milk on the average skims 12 per cent cream and leaves 88 per cent skimmed milk, we find that from the 34 billion pounds of milk devoted to butter-making, only about 4 billion pounds went into butter and over 30 billion pounds was left as skimmed milk.

THE skim milk that is left on the dairyman's hands after he has removed the cream for the manufacture of butter represents no less than 37 per cent of the total bulk of milk production of the country. This skim milk is used as a stock feed with great success; it is accordingly obvious that it possesses food elements of value. What these elements are, and what prospects may exist of using them directly for human sustenance, without first passing them through a pig or a chicken, is a very timely topic in these days of high living costs; and Mr. Dahl tells us in illuminating fashion what the Government is doing in the effort to find out.—THE EDITOR.

Of this vast amount of skimmed milk, not over two per cent was used directly as human food, in the form of cottage cheese, powdered skimmed milk or other product. The balance was used for stock feeding, and much of it was thrown away. Government agents who made an investigation of a number of creameries in all parts of the country found many instances where thousands of gallons of skim milk were poured into the sewer because there was no market for it, and conditions were not even suitable for feeding it to stock.

When skimmed milk is fed to animals, science estimates that only about 30 per cent of its food value is returned to mankind in the meat or fat secured from slaughtering the animal, while 70 per cent of the food solids fed have been used by the animal in the mere act of living. While skim milk is good for stock, the fact remains that its highest efficiency cannot be had through turning it into meat. Skim milk is used most economically in animal production when fed to hogs, yet it takes 20 pounds when fed alone to produce 1 pound of pork. The same quantity will make 3 pounds of cottage cheese. In addition, cottage cheese contains 1½ times as much protein and one-third as much energy as pork, so that the skim milk in the cheese form gives quite as much energy and 4½ times as much protein as it would if converted into ham or bacon. Even at the highest prices paid for hogs, skim milk fed to them is worth not more than 1 cent a pint. and 1 cent a pint, or a pound, is very cheap for any human food, and particularly for a food so high in nutritive value as skim milk.

Skim milk contains all the food elements of whole milk except the fat. There are the proteins, the carbohydrates, the mineral salts and the water, and according to Dr. E. V. McCollum, of Johns Hopkins University, and E. B. Hart and H. Stennback of the University of Wisconsin, about half of the fat soluble vitamine remains in the milk after the cream is removed, and most of the water soluble vitamine, so every pound of skimmed milk is a pound of valuable human food and can be used as such.

Dr. Marion P. Hopkins, of the Baltimore Health Department, has recently called attention to the fact that while a very large number of children in the congested districts of Baltimore suffered from undernourishment, thousands of gallons of skimmed milk were being dumped into the sewers by the dairymen, who had skimmed the surplus local supplies for the butter-fat and thrown away the skimmed milk. He said that if a portion of this wasted food had been given to the children, much of the trouble from underfeeding would have been obviated. Similar conditions have been brought to light in other large cities.

While it is recognized among dairymen and food experts that there is a tremendous waste of good human food in the present practice of handling milk, the difficulty is in successfully marketing skimmed milk as such. To begin with, it is a perishable product and must be handled quickly; it is almost tasteless and lacks the rich color of whole milk. Dieticians know that skimmed milk is valuable as a cooking ingredient,

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Nature's Geometric Workmen

Microscopic Animals That Lay Down Stone Skeletons of Amazing Form

By William Butterfield

MOST of us have admired, in the specimens of Chinese carving that have come under our observation, a piece of ivory cut in such a manner that series of beautiful perforated balls are produced, the lesser fitting within the greater; indeed, men of all countries for centuries have admired the genius and dexterity of John Chinaman in producing such artistically puzzling results. And so has the world marveled at the skill and patience of the workers of all nations; their exquisite carvings on wood, metal or stone; their intricate scrolls and patterns on reticulated mountings for paintings, jewels and porcelains; their buildings, monuments, machines and other complicated creations—all attesting to the persistent industry of man as a group, yet, like the crystals of frost on a window pane, created with slight lasting practical service to creation.

Whereas the Nicabar Islands and the island of Barbados stand as permanent monuments to a far more persistent, and as skillful, industry of another group of nature's artisans, but so small that a million individuals will not fill a lady's thimble. These minute creatures worked throughout their whole existence to play a most *lasting* important part in the great plan of creation. They belong to nature's creators, man to the destructionists. They created islands that man may decimate or destroy them.

These tiny creatures lived in the ancient seas where they absorbed the flinty matter suspended in solution, and, during the processes of development, each individual provided itself with a silicious or transparent glass skeleton of insoluble properties. These skeletons, as the creatures died, fell to the ocean floor where their bodies soon disintegrated. The insoluble skeletons, however, in time formed deposits hundreds of feet in thickness—in the island of Barbados these remains have a thickness of 1,100 feet, while the whole island is composed of about seventy-five per cent of these skeletons. In the course of ages the deposits were converted into stone, and after other ages raised, by the tilting action of the earth's crust, to become dry land.

That "animals" can by any imaginable process of nature have anything to do with the ultimate formation of stone will be a new thought to many, while the assertion that the skeletons of such minute animals are, during the development of the earth, accumulated in sufficient numbers to form stone from which islands are composed, seems perhaps incredible at first thought.

Proof is in the stone, however, where the skeletons form the major part of its substance, held together by crystalized carbonate of lime. Liquid carbonate of lime is brought to the surface of the earth in the warm waters of thermal springs, thence into the waters of lakes and seas. Here constant sedimentation is continually going on, as the waters become overcharged with lime. This sediment crystalizes, binding together, as in a matrix, the insoluble objects it has covered and surrounded. A common form of this kind of stone, usually found in boulders, is "pudding stone" composed of pebbles cemented together in the manner described.

Remarkable, and, as we shall have to say, minimizing to the vaunted industry of man, this geological history-making is not the most extraordinary peculiarity of this particular group, for there are other microscopic stone-building animals and plants that have contributed to a far greater extent in the recent geological formation of the earth—of which the writer will have something to say in following articles—yet to introduce this peculiarity we must introduce the animal, and of course say something of its position in the catalog of natural phenomena. Such ancient deposits are known as fossil deposits, the skeletons as fossils, and the Barbadian and Nicabar groups are still commonly called by their original scientific name Polycystina. These fossils are progenitors of a present-day more attractive living group, inhabiting all zones of the oceans, from the surface to a depth of five miles. It was not until the introduction of the microscope, however, that Polycystina was known, and the great new kingdom revealed by this instrument cleared so many of the dark "mysteries of the universe"—confined by inexperience to the affairs of our earth alone—and so radically upset the accepted theories of the time, that a perpetual war has

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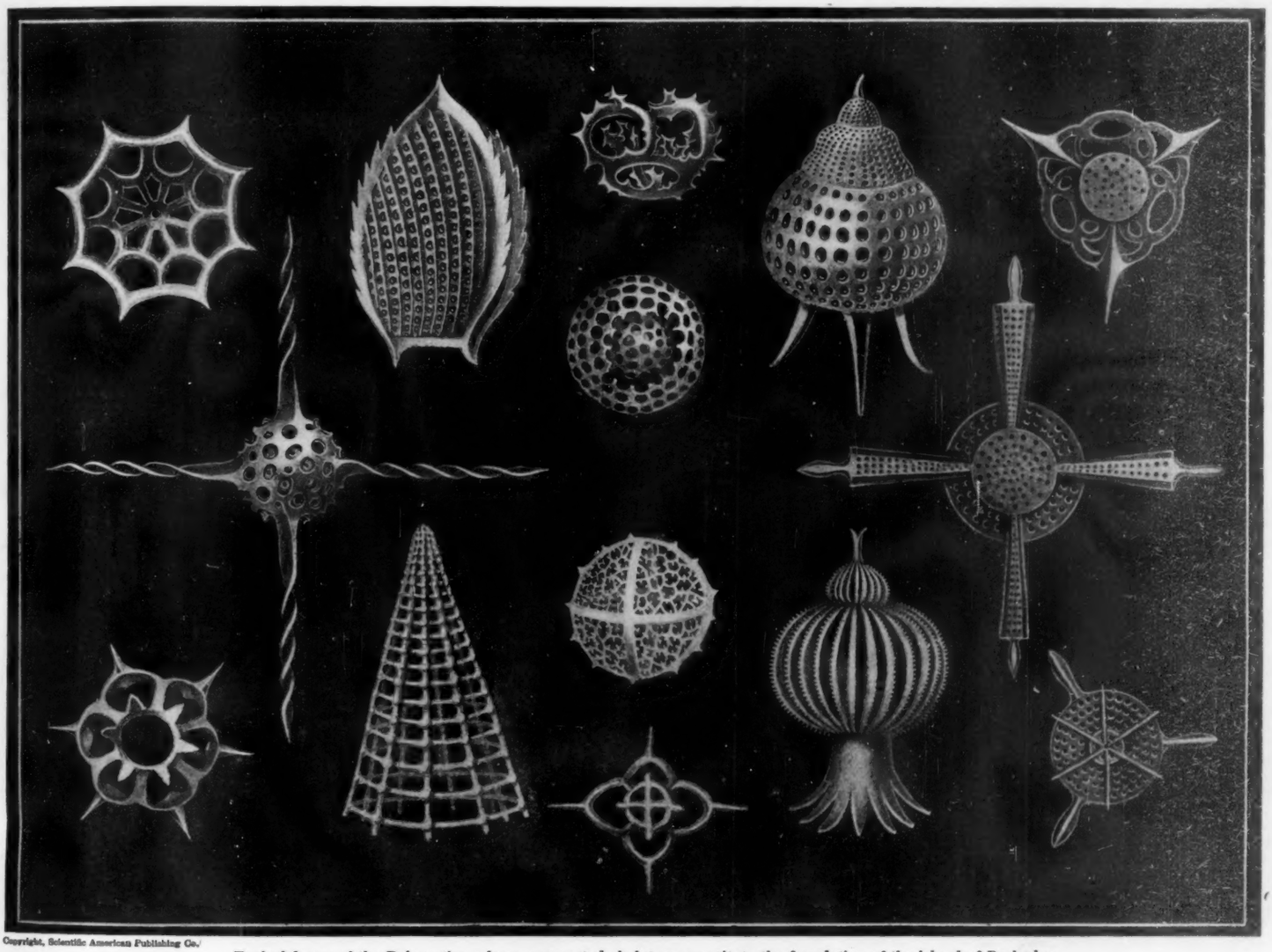


Typical forms of the Polycystina whose aggregated skeletons constitute the foundation of the island of Barbados

How to Get the Most Out of a Motor Truck

Practical Suggestions for the Truck Owner or Driver Who is Interested in Efficient and Economical Operation

By Victor W. Pagé, M. S. A. E.

THE success or failure of motor trucks in any business depends largely on the management of the business, which should make sure that the equipment is adequate for the purpose and of the type best adapted to the requirements of the individual enterprise, and that the loading and maintenance are intelligently supervised to make sure that the trucks will not be abused or depreciate rapidly because of lack of care. The capable transportation executive will consider the quantities and nature of the product coming to the transportation department and the best methods of handling and loading it at the source as well as its distribution to the destination. Working schedules should be devised that will keep the motor vehicles operating at a moderate speed and loaded most of the time they are in service.

A motor vehicle should not be kept in operation more than ten hours out of twelve because for at least two hours out of every twelve the vehicle should be cleaned and inspected. Each vehicle should be washed and the mechanism cleaned once every twenty-four hours. The truck user who is apt to think this an unnecessary procedure should remember that 60 per cent of the maintenance labor on locomotives goes for cleaning and that the average locomotive is thoroughly gone over by a trained corps of specialists every hundred or one hundred and fifty miles of travel. It is important to keep the vehicle clean because if it is not kept clean it will be hard to locate loose or defective parts. Ample provision should be made for regular and systematic inspection of the trucks. If a fleet of trucks is operated a spare truck should always be available to take the place of any one that has broken down in service, or that needs overhauling.

Care Required in Loading

Especial care should be taken in loading a truck so that its normal rated capacity is not exceeded unduly. The drivers should be cautioned to exercise good judgment in the matter of speed as high speeds should only be used when the truck is operated on smooth roads and with light loads. While most trucks are built strong enough so that they may be greatly overloaded without breaking down at once any one who carries a 40 or 50 per cent overload continually will find that this is an expensive procedure from a viewpoint of repair costs. Tires, springs, wheel bearings, and the chassis are all stressed unduly if the truck is overloaded.

OWNER A buys an XYZ truck and drives it a hundred thousand miles with a vanishing repair cost. Owner B invests in the same truck and finds that it is in the shop more than it is on the road, and that he will die of old age before it pays for itself. What is the answer?

Simply that owner A treats his trucks right and owner B does not. The latter will blame the XYZ truck and become an enthusiastic knocker of it; but all trucks will be alike in his service. It pays everybody concerned when trucks are treated right—the owner, the maker, the ultimate consumer who in the long run has to pay the bills. So Major Pagé tells us in this article just what you ought to do to your trucks to keep them running in a state of high efficiency.

The distribution of the load should be such that 80 to 90 per cent will be carried on the rear tires of most forms of trucks. In most designs the center of gravity of the load should be just a little ahead of the rear axle. If any of the load is removed from the rear of the truck the remainder should be distributed evenly and not kept bunched or concentrated at the front end of the body. The weight per cubic foot of different materials varies greatly. It will be evident that it may be possible entirely to fill the body with one material and still be under the rated capacity of the truck, while other substances, such as brick or metal ingots may take up but a small portion of the cubical contents of the truck body and yet the load be greatly in excess of the normal rated capacity. This fact should be considered in loading trucks.

Weights Per Cubic Foot

	Pounds		Pounds
Asbestos	192	Granite	105
Brick	119	Gravel	109
Fire Brick	137	Ice	58
Portland Cement	81	Lime	50
Clay	120	Limestone—broken	85
Anthracite Coal	53	Oil—petroleum	55
Bituminous Coal	45	Salt—coarse	45
Lump Coke	28	Sand—dry, loose	90
Loose Earth	80	Sand—moist, loose	95
Pressed Earth	100	Slate	175
Window Glass	165	Sulphur	127

Truck Lubrication Important

Without question the subject of lubrication is of much more importance to an owner than any other subject, because proper lubrication contributes in no small degree to keeping a not inconsiderable investment at its maximum earning capacity. It does not suffice that the best of workmanship and highest grade materials are employed in manufacture. They cannot give the owner that service he has the right to expect, if this feature is neglected. The best of material will not lubricate a bearing, and the finest workmanship will not keep a truck out of the scrap heap if wearing surfaces are not lubricated regularly. Even slight neglect, not in itself enough to destroy immediately, will have damaging effect upon wearing parts, and will cause not only increased depreciation but lost time, increased maintenance and operating cost and a performance not at all in keeping with that which the truck was designed and constructed to give.

The instructions which follow can be pursued to advantage by drivers and owners of practically all standard trucks:

Motor: The oil reservoir, when empty, will take two to three gallons of oil, depending on the size of the motor. The best oil to use depends on the type of motor and the recommendations of the truck manufacturer should be followed and only lubricant of the best quality used.

The oil filler will be found located at forward end of the motor on the right side in most trucks, though the location will vary. Care should be exercised at all times to see that the oil is kept between high and low marks on the gage usually found at rear end of motor. Watch indicator on dash carefully, and should it not register when motor is running, investigate immediately, ascertaining if the oil line is stopped up, or if the reservoir is empty. The oil reservoir should be drained every five hundred miles through the plugs located at rear of reservoir in the bottom of crank case, and refilled with fresh oil. The reason for this is obvious; the grade of gasoline that is being sold at the present time is such that perfect carburetion is impossible until the motor warms up, resulting in considerable gasoline finding its way into the oil reservoir, which gradually thins the oil until it ceases to be a perfect lubricant. For this reason heavy-bodied cylinder oils are often recommended.

The oil system is nearly always the force-feed type, and pressure is maintained by a positive gear-driven pump located in the bottom of oil reservoir, generally to one side. There is an oil strainer surrounding the pump intake which should be cleaned occasionally. This can be easily removed for cleaning by simply taking out cap screws or unscrewing a plug. A grease cup is provided on the fan. Fill this with grease weekly and turn every day. Do not overoil the magneto. One or two drops of three-in-one oil injected into the oil wells every thousand miles will be sufficient. One of these wells is located on the top of the distributor housing, oiling the armature ball bearing, the distributor plain bearing and the oil wick in the timing lever body. The other oil well will be found on the extension of the end plate at the driving coupling, and lubricates the ball bearing on that end of the magneto.

Remove the oil-filler screw of the governor and fill chamber weekly, using medium heavy cylinder oil, 600-W is preferable for summer, and in winter add to it an equal amount of light machine oil. Every 500 miles remove drain screw, filling half full of very light machine oil, run for an hour to clean interior and drain out. Refill the chamber with a good grade of medium heavy cylinder oil. Be sure the governor does not run without oil, as it might injure its bearings. Keep screws with copper washers tight to prevent oil leaking. Connect with wire to prevent losing them. See that the engine drives are well lubricated by regularly filling the oil and grease cups.

Chassis Parts

Grease cups are provided at all points on the front axle where friction comes. Make sure that the grease cups are filled with a high grade light grease free from acid and grit. Keep reserve supply of grease in a tightly covered can so that no grit or dust can get into it.

The bearings in the front wheel of most trucks are tapered roller forms and may be lubricated with any light grease or heavy oil if it is positively free from acid. Plugs are provided in the wheel for lubricating the bearings and in addition the wheels should be removed periodically, the bearings thoroughly cleaned with kerosene and relubricated with light grease, using a clean wooden paddle for spreading.

The transmission should be filled to about 1½ inches above center line of the main shaft with a good grade of heavy transmission grease. No lubrication of the clutch is necessary if a dry plate or cone clutch is used except that the clutch throw-out bearing should receive regular lubrication. This is generally provided for by a large grease cup located on the floor board which should be given one turn every morning or noon.

Oil cups are provided on the steering gear and they should be kept filled with a good grade of light oil. At each end of the drag link is a socket in which the ball of the steering arm operates, as well as the arm on the knuckle arm. These should be thoroughly greased at least twice a month. Grease universal joints weekly with a good grade of cup grease, using grease gun, and once every three months joints should be completely taken down, thoroughly cleaned and repacked.

Oil cups on brake flanges and grease cups should be given attention once a week. These lubricate the internal brake cams of the rear axle. All external brake joints should be given a few drops of oil once a week. The large internal gear inside of brake drum and bolted to wheel in the internal-gear axle should be lubricated once every month by removing wheel and applying a new coating of grease to the teeth. This must be a very heavy grease which will not flow under any conditions of heat. If grease cannot be obtained thick enough, mix graphite with it until it is thick. Put on no more grease than just sufficient to cover the faces of the teeth lightly. If more is put on, it will interfere with the action of the brakes and will leak out, giving the wheels an untidy appearance. A hand hole is provided on some models for inspecting and lubricating the internal gear. Fill differential gear-case one-third full of heavy oil or very light grease. Do not fill over one-third full. Be careful with a worm-drive axle to use only the best grade of fluid oil as recommended by the makers.

Every six months take out drain cap in the bottom of case and thoroughly rinse out old lubricant with kerosene by pouring it at top cap. After rinsing out with kerosene then fill with lubricant as above instructed.

Rear hub bearings can be given sufficient grease by simply removing hub cap and filling this with grease, screwing back on in position. This should be done about every three months. When wheel is removed for lubricating internal gears, thoroughly wash out hub bearings with kerosene and gasoline, applying new lubricant. Pipe plugs will be found located on outside of some wheel hubs, and medium weight grease should be inserted weekly, utilizing a grease gun for this purpose.

Every six months the springs should be taken apart and lubricated with a good grade of grease mixed with graphite. Spring-bolt bearings are provided with oil cups and should be oiled daily. There are numerous other points of friction such as control rods, cross rods, rocker shafts, etc., not mentioned where a drop of oil occasionally will materially benefit. The one

(Continued on page 644)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

Tungsten and Turbines

To the Editor of the SCIENTIFIC AMERICAN:

The article in your very interesting first type-written number of October 25, on the fusion and uses of tungsten, suggests still another use for the metal. If tungsten, or some other highly refractory metal, could be produced cheaply enough, and cast in pieces large enough, and shaped as desired, then we could build a practical gas turbine. For if the blades at the high pressure end of such a machine, and perhaps the casing also or at least the lining of it at this end, could be made of a highly refractory metal, so that a constant stream of gas at, say 1,000° Centigrade, could be directed upon the blades without injury to them, then we would get a wonderfully efficient engine. A drop in temperature from 1,000 to 100° Cen. would give a theoretical efficiency of 72 per cent. If only two-thirds of this were realized, we would still have an *actual* efficiency of nearly 50 per cent, much beyond that of any existing engines. To this advantage may be added the increased lightness and compactness. Steam turbines are already far lighter and compacter than reciprocating engines of the same power. But with an internally fired turbine, the boilers and furnaces are done away with, so that the saving in space and weight is very great.

Such an engine would be exceedingly adapted to airplanes, not only on account of the efficiency and lightness, but also because the simple rotary motion would do away with most of the vibration, which at present taxes the strength of the plane almost more than the mere weight of the engine. The gain is really three-fold. For the very same power the engine is lighter and smaller, enabling lighter construction, the absence of vibration enables still lighter construction, while the higher efficiency cuts down the weight of fuel, fuel tanks, and tank supports required. Hence every pound saved is here *three* pounds earned.

If an airplane were equipped with an engine sufficiently powerful in proportion to its weight, it would be able to pull itself straight up in the air. It would then need no wings, except diminutive ones to steer and steady it, and to oppose the reaction of the engine. It could alight gently on the tip of its tail, on the deck of a small boat, or on the roof of a building. It could hover like a humming bird over any object which the pilot wished to examine closely. Hangers would then most conveniently consist of groups of vertical tubes open at the top, into which the aviators would gently insert their machines, tail end first, like bees in a honeycomb. Such an arrangement would be very compact, and would moreover save the weight and head resistance of a landing gear, thus earning a fourth pound. Hangers would be constructed on the roofs of buildings. A man would fly to his business, check his machine with the roof-boy, and go down in the elevator. A still greater saving than any of the above would be effected, if by some system of eugenics, we could raise a race of roof-boys that would refuse to take tips. They would of course have to be raised to their jobs.

All this may be only a fantastic dream, but we have recently seen enough helium produced to fill an airship, a gas which very shortly before had been known only in test-tube quantities. So why may we not hope to see some day produced in commercial quantities, a refractory metal that will enable us to run an engine at 1,000° continuous temperature, and airplanes to perform the antics mentioned? It does not seem half so improbable, as the production of the desirable race of roof-boys above mentioned. M. C. MOTT-SMITH.

Los Angeles, Cal.

Cheap Navy

To the Editor of the SCIENTIFIC AMERICAN:

Your editorial in issue of October 18, 1919, concerning the peril of our Navy, is a timely one, and the writer, for one, is more than pleased to see this subject brought up.

The writer, a married man with three children to support, enlisted for the duration of the war, and found the life of a Gob full of interest. He did not, however, get an opportunity to get on board ship—spending seven months at Great Lakes as a cook.

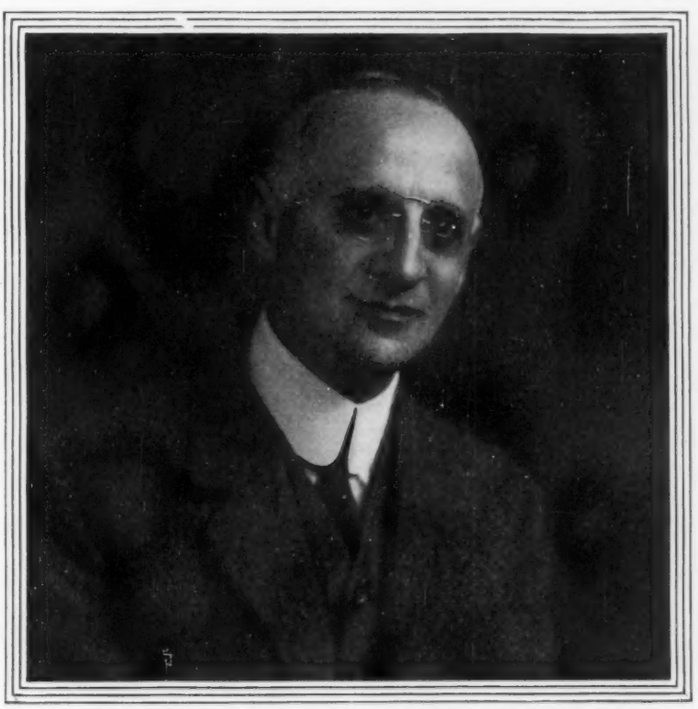
The financial loss to the writer for seven months' service was exactly three hundred dollars, which he had to make up as soon as released. As a matter of fact, he is not entirely squared up yet. If money earned in our Navy would come anywhere near supporting a family, your orator would be more than pleased to serve, and can name many others, men of proven ability, who would be a decided asset to the Navy, who would gladly do their bit, if they could support their children.

The writer earns in civil life $7.50 per eight-hour day, against $50 per month in the service. How can the United States Government expect to keep men in service in view of that fact? And yet, that is the case everywhere. Every married reserve was forced financially to seek his release at the earliest possible moment.

Trusting to see this matter pushed to a successful conclusion for the benefit of the Navy at large.

JOSEPH E. PADBURY.

Racine, Wis.



Simon Flexner, new President of the American Association

Roller Skates in the Factory

To the Editor of the SCIENTIFIC AMERICAN:

Your correspondent, W. B. Wiegand, may be interested to know that more than twenty years ago this method of locomotion for messengers was tried in London, England, and failed miserably. The skates were two-wheeled, fore and aft, rubber-tired and of excellent workmanship. I think they were manufactured in England. There was a retail store in the Strand. That they were not a success a little reflection on the part of your correspondent will easily demonstrate. This only holds good in such cities as London, New York, Chicago, etc. But then we are our own messengers in lesser cities.

COLIN STEWART.

Waukesha, Wis.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of September 27 we note a communication from W. B. Wiegand in regard to using roller skates for messenger boys in factories.

A prominent motor truck company of this place at this time equips its stock chasers and factory messengers with roller skates, which facilitates work of this kind where the boys have to get over considerable territory. Much time is saved in this manner.

ROLFE C. SPINNING.

Wabash, Ind.

The Incoming President of the A. A. A. S.

By Marcus Benjamin, Ph.D.

THE American Association for the Advancement of Science holds its annual meeting this year in St. Louis, Mo., to which city it returns after an absence of sixteen years; and there has been called to preside over its deliberations in succession to John M. Coulter, eminent among botanists, one of America's most distinguished pathologists.

Simon Flexner is the son of Moses and Esther (Abraham) Flexner, and was born in Louisville, Ky., on March 25, 1863. After studying at the public schools of his native city, he entered the University of Louisville, where he followed the medical course and was graduated in 1889 with the degree of M.D. During his undergraduate career he developed unusual ability in pathology, and determining to specialize in that branch, he turned for his post-graduate studies to the Johns Hopkins University where he was most fortunate in coming under the influence of Prof. W. H. Welch and Prof. W. T. Councilman, now of Harvard. Later he also studied in Paris, Strasburg, and especially in Berlin, where his teachers included such masters as Hans Chiari, Emil Fischer, F. D. von Recklinghausen, and Ernst Salkowski.

His aptitude in his specialty naturally and speedily led to his appointment on the faculty of Johns Hopkins where from 1891 to 1899 he was first associate and then full professor of pathological anatomy. In 1899 he accepted a call to the chair of pathology in the University of Pennsylvania where he remained for five years.

Meanwhile other appointments, all of which testified to his eminent ability, were extended him. These included the office of Pathologist to the University Hospital and the Philadelphia Hospital in 1900 and the directorship of the Ayer Clinical Laboratory of the Pennsylvania Hospital in 1901. He was appointed a member of the Johns Hopkins University Commission for the Investigation of Tropical Diseases to the Philippine Islands in 1900, and he served on the Government Plague Commission to San Francisco, Cal., in 1901.

It was therefore only natural that when the Rockefeller Institute for Medical Research was founded in New York that he was at once chosen to direct the laboratories of this munificent benefaction, which appointment he accepted and still holds, supervising with masterful skill those splendid researches that have added so much to our knowledge of the causes of disease.

His investigations have been many and important. They began at the Johns Hopkins University where he assisted Professor Welch in his pioneer demonstration of the pathological changes produced by the experimental injection of the toxins of diphtheria in 1891-2, simultaneously with von Behring. He made an important experimental and statistical study of the terminal infections in 1896, and then investigated prevalent diseases of the Philippines in 1900. He studied snake venoms with relation to haemolysis, bacteriolysis, and toxicity with H. Noguchi in 1901. Later (in 1907) he investigated infection by diplococcus intracellularis and its serum treatment, and he made important investigations on the causes and treatment of cerebro-spinal meningitis in 1909, as well as experimental infantile poliomyelitis in 1910-13, culminating in the isolation of an organism of poliomyelitis in 1916.

Other activities for which he deserves recognition include membership as a trustee on the Rockefeller Foundation, and membership on the Medical Advisory Committee of the American Red Cross. With the breaking out of the Great War he was called to the colors and served his country with the rank of major. He was made a Chevalier of the Legion of Honor by France.

Dr. Flexner is not a very old member of the American Association for his membership dates back only to the Washington meeting in 1902 but in that year he was active in the organization of Section K on Physiology and Experimental Medicine, over which he was chosen to preside at the Ithaca and New York meetings in 1908. Meanwhile in 1905 he had been advanced to the grade of Fellow, and at the Baltimore meeting in 1918 he was chosen to the highest honor within the gift of the association.

The Tendency of Truck Design for 1920

Few Mechanical Changes Because of Satisfactory Operation of Existing Designs and Great Demand

THE past year cannot be said to have been one of marked engineering development in motor truck design; in fact, there have been very few changes in mechanical construction because the makers of motor trucks have been so hard pressed to meet the demand for their product that they have had but little opportunity to make changes. The engineering talent that has been employed in previous years in evolving new designs and refining details is now expended in speeding up production in an effort to supply the market with the motor vehicles it demands.

In reviewing the specifications of the product of the motor truck producers of this country, the first and most striking point that meets the eye is the slight increase in selling price of trucks, despite the high cost of materials and the restricted output of higher paid labor which would lead one to expect a materially higher selling price than prevailed before the war. The increase has only been about 10 per cent in the 6,000-pound capacity class, which has seen the greatest increase and an average of approximately 5 per cent if all classes from the lightest to heaviest trucks are taken into consideration. The price increase has been materially less than was expected in view of the augmented cost of production and is very reasonable when compared to other commodities which have been raised in price anywhere from fifty to a hundred per cent over the pre-war figures.

Refinement of Detail Noted

The changes that have been made in construction are for the most part refinements of detail that do not appear on casual inspection. Such a detail as deepening a frame channel section and using larger spring shackle bolts and bearings or improving the braking mechanism by better proportion of parts are features that would not be apparent on a cursory examination and cannot be considered as any marked forward movement in truck design even though the mechanism is improved by the changes and depreciation lessened by such improvements. It is evident that a point has been reached in automobile design where any radical changes are not necessary or desirable and any established manufacturer who brought out a radically new truck would lay himself open to the suspicion that the preceding year's product had not been satisfactory. There is no real reason for changing present truck designs which have been tested and not found wanting in the severe tests of active service during the past emergency, not only in war-torn Europe, but in the multitude of less spectacular but equally arduous domestic applications in various industrial lines.

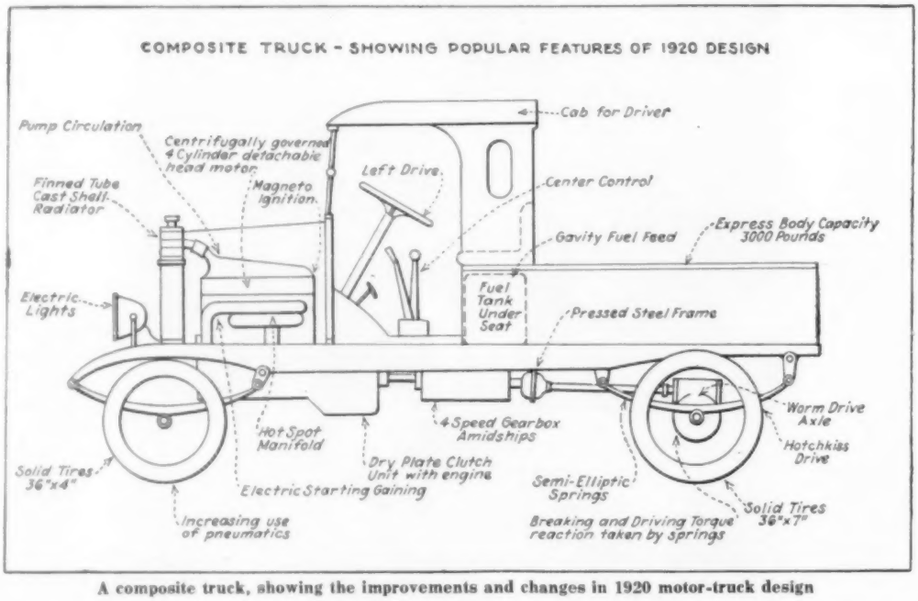
When a mechanism has been developed to a point where it can be depended on for long distance hauling and heavy duty work on regular schedules, as motor trucks have, there does not seem to be any real reason for changing the construction and substitute experimental designs, that may have advantages in theory but which are untried in practice, for those that have made good in many and varied uses.

Few Well-Defined Tendencies in Truck Design

There are certain well defined tendencies in design, however, that merit mention. One of the most important is a growing realization of the value of metal wheels in either the steel disk or cast spoke forms, steel pressings being used for the former and semi-steel for the latter. The truck user operating fast, medium capacity vehicles is being educated to the point where the thought of giant pneumatic tires does not alarm him because great improvements have been made in the construction of these tires that give them a service life comparing favorably with that of the solid tires, besides gaining the added advantage of smoother riding which reduces depreciation of the mechanism and enhances the comfort of the driver. This also makes greater speeds possible and correspondingly augments the ton-mileage efficiency. Special forms of rims make replacement in event of puncture less difficult and a fully inflated spare can be carried on a demountable rim for replacement purposes just as is done in passenger car practice.

Realizing that the inflation of these giant tires to the high air pressures they must carry is a task that would prejudice any driver forced to inflate one with a hand pump against them, a number of manufacturers who are using such tires are fitting a mechanical pump, actuated by the engine, as regular equipment for this purpose. On the heavier vehicles that must attain more than the usual speeds thought advisable for solid-tired trucks, the application of one of the several types of cushion wheels in which rubber cushions are interposed between the wheel felloe and the hub to supplement the action of solid tires is sometimes noted. One of the newest developments along this line is a form of wheel in which an arrangement of coil springs is employed to reduce the shock transmitted by solid tires, especially when these are mounted on wheels that lack resiliency or shock-absorbing properties because their designers had to compromise these features in securing maximum strength.

Pneumatic tires are now offered as regular equipment on 15 trucks of 1 to 1½ tons' capacity and on three heavier models, one of these being 7,000 pounds' capacity. A number of truck manufacturers who favor solid tires on the rear wheels are providing pneumatic tires on front as regular equipment and pneumatic tires all around as an option. In the lighter delivery wagon class, that is trucks with a capacity ranging from 1,000 to 1,500 pounds, which are really modified passenger car chassis, air-filled tires have always been standard equipment.



A composite truck, showing the improvements and changes in 1920 motor-truck design

Truck Price Varies Inversely as Capacity

An interesting point noted in analysing the trend of practice is the variation in price per pound with capacity. As a general statement which might be questioned by considering only certain specific designs irrespective of the others, one can say that trucks up to 1 ton capacity sell for about $1 per pound rated capacity. Trucks up to 3½ tons' capacity and over 1½ tons average 50 cents per pound rated capacity and the heavier trucks may sell as low as 25 cents per pound and approximate 33 1/3 cents per pound load rating in average cost.

The most popular truck capacity, if one can judge by the number of makers producing them, is 3,000 pounds as nearly 100 makers are offering models of this load rating. Next in popularity comes the 4,000-pound with about 75 models, then the 7,000-pound capacity with sixty makers offering them. There is little to choose between that model and the 5,000-pound because about the same number of models of each of these capacities are available. The production of trucks for last year is given as 250,000 and for the coming year is estimated at over 300,000 though this figure seems to be based on optimistic reports which do not take into account such disturbing factors as scarcity of materials or inadequate and excessively high-priced labor, both of which factors must result in a reduced output which cannot fail to fall far short of the demand if business conditions remain as they are now.

The type of final drive to be used has been the subject of considerable controversy in the past, especially between the adherents of the internal-gear principle and proponents of worm-gear power transmission. There are two ways of looking at this proposition in gaging the popularity of either type. If one considers the matter from the number of different models offered one finds a preponderance of designers, if one can credit each model to some one engineer, in favor of the worm drive, there being over 60 per cent of the models offered that use axles having this efficient gearing. On a basis of models, the internal-gear axle is gaining from last year, at which time 20 per cent of the models used this drive while for the 1920 season, over 25 per cent of the models will be equipped with internal-gear axles. The internal-gear drive system has much in its favor and one can expect a constant growth in the number of its users. If one considers the matter from a viewpoint of production, one will find that a type of drive that is found on only 3 per cent of the models is used on about 15 per cent of the total number of trucks manufactured. The reason for this seeming inconsistency is that some quantity producers of but one model use bevel gearing, which is the standard in the passenger car practice from which these trucks were derived. There are fewer makers using chain drive, but it is retained as standard equipment by several manufacturers of prominence and will be found on about 5 per cent of the models for 1920. There has been no change worthy of mention in the usual drive situation over last year except the gain noted for the internal-gear drive principle.

Four-Speed Gearboxes More Popular

In the matter of the number of speed ratios in the transmission one notes an increasing disposition on the part of manufacturers who used three-speed gearboxes in trucks of all capacities up to 6,000 pounds to adopt the four-speed gearbox on such trucks. As previously mentioned in these columns, the experience obtained with the four-speed gearbox in the class B of Liberty war truck has brought out the advantage of having a lower gear reduction than is available in the simpler gearbox for use in emergencies where great tractive power is needed. Another tendency is a change in the mounting of the gearbox, which in many cases was a unit with the engine. When a four-speed type is used in conjunction with the engine to form a unit power plant and where the frame is unusually long it is customary to use two relatively short shafts and a supporting bearing rather than using a very long propeller shaft, which is subject to "whipping" because of a slight deflection due the distance between supports at the gearbox and rear axles, respectively. Using tubular section shafts minimizes this because the section is increased without a corresponding weight increase. Even this augmented stiffness or resistance to bending does not prove sufficient if a very long shaft is employed. The propeller shaft length is materially reduced when the gearbox is located amidships as now seems to be the trend of practice.

Considering the power plant design, we find more

(Continued on page 653)

Antics of a Commercial Dirigible

OUT of Germany comes an interesting report on the operation of the dirigible "Bodensee," which has been in regular commercial service for some time past, conveying to a credulous world the impression that the day of the passenger-carrying dirigible is here. Practical commercial dirigibles may be an immediate possibility, but for the time being they exist in the form of blueprints and lengthy specifications. That, in brief, is the new impression conveyed by a review of what the "Bodensee" has done.

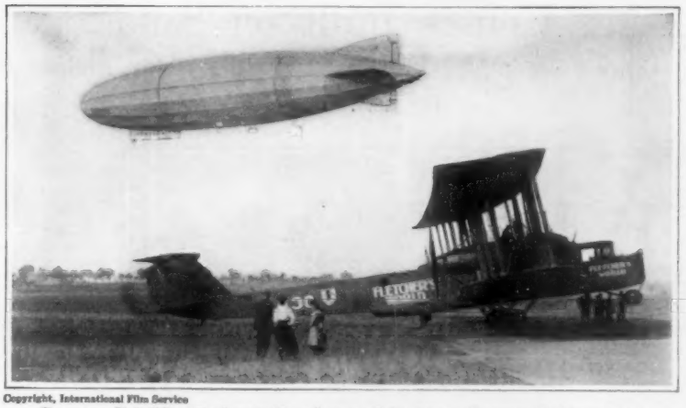
During the first month's service, or from August 24th to September 23rd, the good airship "Bodensee" carried 1,300 persons in 30 voyages of 208 hours' duration, thereby covering a distance of 20,000 kilometers (12,000 miles) without any incidents.

But subsequent service, especially during the windy days of fall, did not prove quite so smooth. The "Bodensee" on a voyage from Friedrichshafen arrived at the airdrome near Berlin at 6:30 p. m. on November 2nd. About thirty persons were in the airship. The wind was very strong. No order was given for landing the vessel, and the crowd who were holding the landing ropes appeared to be friends of the passengers aboard the airship, with the exception of some half-dozen officials.

The "Bodensee" nose-dived five times, and bumped the ground three. One of the people on the ground was killed and five were injured. The Zeppelin then ascended, the lights went out and she vanished. When the airship had been held down the passengers were able to speak to their friends on the ground. One lady was heard to tell her husband that they had had a very bad voyage, and that she would never undertake it again.

The Hamburg-Amerika Line afterwards issued the information that the vessel was safe, and same down in the Harz Mountains. All the passengers were saved. The ship was not seriously damaged, and will return under its own power.

All of which points out the weakness of present dirigibles when operating in windy weather, such as prevails through at least half the year in most countries. With larger airships equipped with more power, together with the use of the mooring tower as described several times before in these columns, it will be possible, no doubt, to operate in gusty winds with a minimum of danger.



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German dirigible "Bodensee" and one of the large German biplanes with 130-foot spread and four engines

Doubling a Bus's Rainy Day Capacity With a Rainproof Top

NEW YORK'S motor buses are double-deck affairs, similar to those used in London, Paris and other leading cities. The upper deck is open and while the majority of passengers seek that part of the bus in good and warm weather, the first signs of rain or cold drives all the passengers into the closed portion below. So it is not far from the truth to say that a bus's capacity is practically cut in half during inclement weather.

With a view to overcoming this drop in passenger traffic, the bus company operating in New York has recently experimented with rainproof tops. One of these is shown in the accompanying illustration, in use during rainy weather. A windshield at the front protects the occupants of the upper deck against wind and driving rain. The top can be folded forward and out of the way during good weather.

Copyright, Underwood & Underwood

This special rainproof top doubles the capacity of the bus during rainy weather

Making Evaporation Take the Place of the Ice Man

WHERE ice is not obtainable an iceless refrigerator, home-made, will be found useful to keep meat, fruit and vegetables cool. It will extend the keeping period for milk and butter and serve also as a cooler for drinking water.

The construction of the iceless refrigerator is shown in one of the accompanying illustrations, the dimensions being 42 by 16 by 14 inches for the wooden frame. Adjustable shelves can be made of solid wood or strips, or sheets of galvanized metal. Shelves made of poultry netting on light wooden frames are probably the most desirable. A cover of canton flannel, burlap, or duck is made to fit the frame. This cover is buttoned around the top of the frame and down the side on which the door is not hinged, using buggy hooks and eyes or large-headed tacks and eyelets worked in the material. Four double strips at the lower end of the cover drip in a basin of water, and act as wicks to draw up water.

Operation of the refrigerator shown in the illustrations is as simple as its construction. The lowering of the temperature inside the refrigerator depends upon the evaporation of water. To change water from a liquid to a vapor, or to bring about evaporation, requires heat. As the evaporation takes place heat is taken from the inside of the refrigerator, thereby lowering the temperature of the inside and contents. The lower pan is kept filled with water. The water is drawn by capillary attraction through the wicks and saturates the cover. Capillary action starts more readily if the cover is first dampened by dipping it into water or throwing water upon it with the hand. The greater the rate of evaporation the lower the temperature which can be secured. Under ideal conditions the temperature has been known to be reduced to 50 degrees Fahrenheit. Obviously, weather conditions have a lot to do with this refrigerator. A warm, dry day, with a slight wind, if possible blowing on the cover, produces the best results in maintaining coolness of contents.

Evaporation of the water drawn up by the flannel cover serves to keep food cool in this little cabinet

Why Iron Sticks in Concrete

THE essential factor in the resistance exhibited by reinforced concrete resides in the adhesion between the iron and the cement. This adhesion is usually attributed to a sort of gluing action between the iron and the cement analogous to that between bricks and mortar. This is denied, however, by a recent experimenter, M. Vasilesco Karpen, who has just laid the results of his investigation before the Academy of Sciences in Paris.

If the cement employed in making reinforced concrete is poured upon a sheet of iron the adhesion observed is very much less than that exhibited in reinforced concrete. Moreover, it depends essentially upon the state of the surface of the iron. For example, if this surface is smooth and oily there will be no adhesion. Experiments made with bars of iron which are *imprisoned*, show on the contrary that there is adhesion between the iron and the concrete, even if the bars are painted or oiled, though in this case there can evidently be no question of any gluing action.

M. Karpen is of the opinion that *this solidarity is due to the friction* between the iron and the surrounding concrete. He calls attention to the fact that the concrete contracts while setting; the bar of iron imprisoned within it is therefore gripped firmly by the contracted concrete, so that if an attempt be made to withdraw it it will be retained by friction. We are obliged to omit the elaborate calculations which the investigator employs to prove his point, merely stating his conclusions. He finds that the adhesion between the materials increases with the lapse of time just as the amount of contraction of the concrete does. While it is quite true that iron can also be glued to cement, this gluing action is not only slight and uncertain in amount, but can exist only through the contraction of the concrete and must cease if the latter expands even very slightly.

M. Karpen was led to undertake the study of this question by the observation of reinforced concrete works in the process of being demolished. He noted that the concrete ceases to adhere to the iron unless the latter is entirely surrounded. As a general thing in the calculation concerning structures in which reinforced concrete is employed, no account is taken of the contraction of the concrete, since this factor is considered as being too uncertain. M. Karpen's theory, on the contrary, demonstrates that it is precisely this factor which produces the indispensable solidarity between the two materials, and shows the capital importance which must be attributed to the knowledge of the coefficient of contraction of the concrete.

Houses Built on Sand

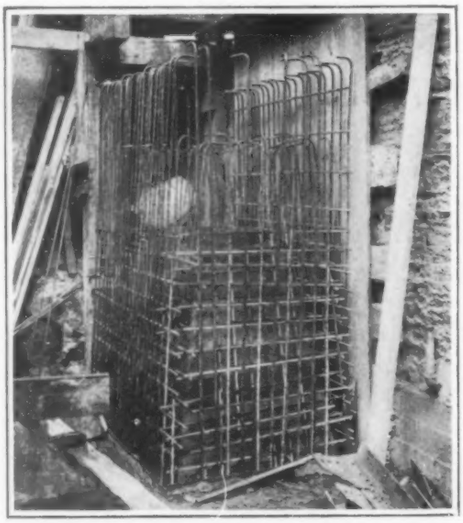
How the New York Assay Office Foundations Were Safely Laid Without Endangering Adjoining Buildings

By J. F. Springer

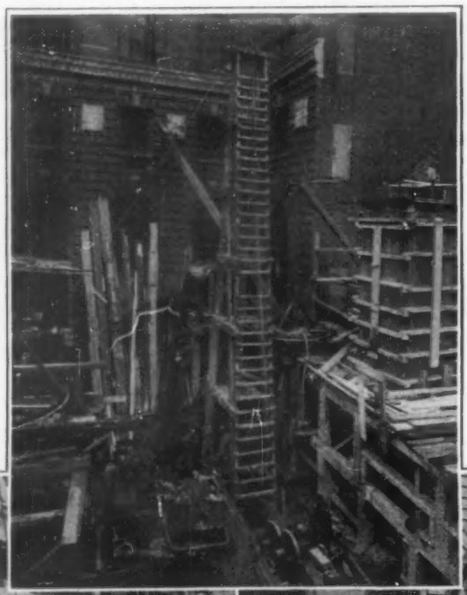
THAT part of the financial district of New York which is located in the neighborhood of the junction of Wall and Nassau Streets is underlaid by a good deal of quicksand which proves troublesome whenever a foundation for a heavy building is to be carried all the way down to solid bed-rock. However, there are buildings in the district which were constructed years ago and which do not stand on rock at all. Thus, the Gallatin Bank Building which stands on the east side of the extension of the Government Assay Office, now under construction, with its front on Wall Street, is a case in point. This building is a nine-story affair, and yet its wall along the eastern boundary of the extension has a concrete foundation resting on dry sand some fifteen feet below the curb. In the general region, there are probably very many buildings which have their ultimate foundation on sand.

As ground water is met at a depth of, say, 15 or 20 feet below the street, one is not to be surprised to learn that numerous buildings are underlaid by quicksand. The reader may wonder that important buildings rest on something quite different from rock and that many of these are underlaid by more or less extensive blankets of sand possessing, because of its saturation with water, a great deal of fluidity. However, one is to remember that sand, whether wet or dry, will support a load, provided there is no chance of escape. A building may, accordingly, often be quite safe, even though sand supports it. However, if the pocket or blanket of sand is cut into by the excavation for a nearby foundation, the building may be threatened. Even the unwatering of an excavation at a considerable distance may result in dangerous settlement.

In view of the foregoing, it will readily be understood that the decision to excavate the site for the Assay Office Extension to an average depth of some 14 feet as a preliminary to the further excavation necessary for the foundation piers imposed upon the engineers the necessity of protecting the adjacent walls of the Gallatin Building. Support was provided by sinking a very special type of concrete pile beneath the walls. These piles are made up of concrete sheathed in steel. The steel sheath is first forced down to the required level or until a certain resistance is realized. Then it is cleaned out and filled with concrete. Up to the time the concrete is poured into the sheath, the weight from the wall and the resistance of the pile are transferred through the jack surmounting the pile and set beneath the wall. In fact, the jack is set into a recess in the wall and the latter's weight is employed as the reaction necessary to enable the jack to drive the sheath. The steel shell, constituting the sheath, was in the present case made up of 5-foot sections, 15 inches in outside diameter. The section that is ultimately to be the lowermost is first forced into the soil by the jack. Then a second section is attached by means of a flush screw coupling and the pair forced down. This procedure was, in the present instance, continued until hard-pan was reached, a 60-ton hydraulic jack being employed. The principal solid contents of the sheaths—the sand, small stones, etc.—were dug out by a diminutive orange-peel grab bucket. The remainder of solid matter and the water in the sheath were driven out by the use of compressed air. The hard-pan bottom and the interior of the sheath could then be inspected by means of an electric-light bulb let down on the inside. An 80-ton load was applied as a test and the sheath filled with concrete. A heavy cast-iron plate was laid on top to serve as a cap. It was necessary, in order to relieve the jack and permit its withdrawal, that the weight of the wall be transferred to something which could replace the jack as a transmitter of load and resistance and which could also be left in place. The substitute for the jack was provided by blocking up the vertical interval and wedging until the load was sufficiently transferred to permit the jack to be relieved.



Detail of a reinforced concrete caisson wall

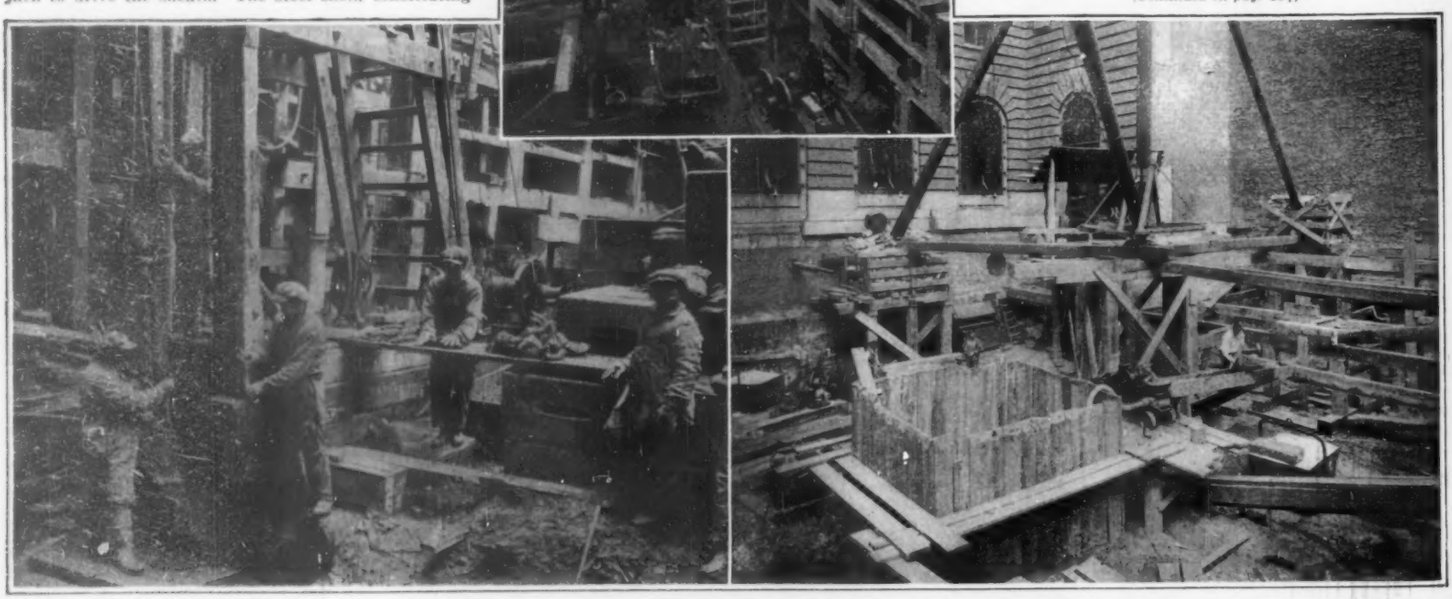


The eastern part of the site was provided with foundation piers which require no description in the present article. On the western side, however, a considerable excavation was necessary in order to provide for the sub-basements. The pit required was 36 x 43 feet in plan area and 36 feet deep, the depth being measured from the bottom of the general excavation over the entire site. It had to penetrate sand, clay and quicksand, and, as 33 feet of the 36 were below the ground-water level, the problem had to be solved by methods other than those usually employed, even in downtown New York. It was proposed to combine the need for certain foundation supports in the western part of the general site and the need for the excavation in which the sub-basements were to be constructed. What was ultimately done was to unite foundation caisson piers, arranged around the inner margin of the western part of the site, into an impermeable wall. Such an enveloping wall reaching down to bed-rock would constitute a cofferdam within which all necessary excavation for the sub-basements could be carried on.

Eight cofferdam caissons were put down to rock by the pneumatic system. These varied in dimensions. A large one was 8 x 25 feet in plan while a small one was 5½ x 17 feet.

First of all the cutting edge of angle-bars and the

(Continued on page 654)



Laying the Assay Office foundations in the quicksands of Wall Street

Left: Water-sealing the caissons by ramming clay slugs through a pipe into the space between them. *Above:* Pile-driver used in ramming these spaces. *Right:* General view of the foundation work as it neared completion.

Machine that tests cement briquettes by crushing them under a gradually increasing load of shot

Testing Concrete with a Flow of Shot

THE accompanying illustration shows a new automatic shot cement tester, developed at Philadelphia. The smaller machine of 1,000 pounds capacity has a length of 24 inches, breadth of 10 inches and height of 30 inches, with a weight of 155 pounds. The larger tester of 2,000 pounds capacity has a length of 40 inches and a breadth of 11 inches, the height being 36 inches and the weight 170 pounds.

In order to operate the machine, it is necessary first to place sufficient shot in the bucket to balance the lever system, as indicated by the pointer, then place the cement briquette in position in the clips, taking up the initial load, which may be set at a predetermined point by means of the hand wheel at the base. This forces the bucket end of lever down and gives sufficient lever motion so that when automatic trip is set and the shot is released from the bucket the machine need not be further regulated and thus automatically breaks the briquette.

Then the trip is set after applying the initial load by pressing the arc lever until it engages in cut off lever over the upper clip. The shot is released and flow of shot regulated by means of the slide valve and regulator at the base of the bucket. The flow of shot is instantaneously stopped on rupture of the cement briquette independently of the amount of tension on the briquette. The smaller machine may either be used absolutely automatic or the lever system may be kept in a horizontal position during the test by turning the crank shown at the base, which takes up the motion of the lever system. This device is not essential excepting in the 2,000-pound machine, where sufficient lever motion cannot be obtained and it must be taken up by the use of the crank.

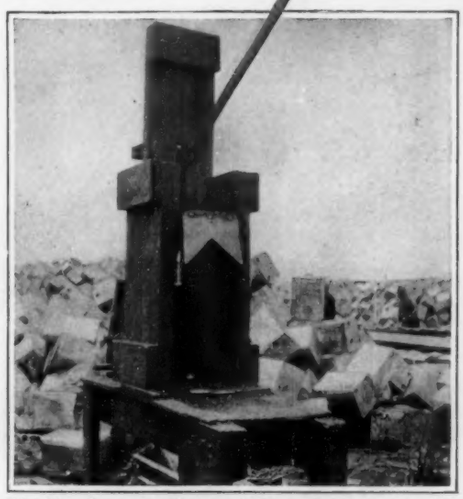
The breaking load is weighed automatically on the scale placed on the frame of the machine so that the operator can watch the application of the load and knows at any instant exactly what load is on the briquette when it breaks, and it can thus be jotted down without further manipulation or calculation. The small hand wheel for adjusting the lower clip is arranged so that it will automatically slip on the adjusting screw as soon as a predetermined load has been applied to the briquette. This hand wheel having been properly adjusted, there can be no strain on the briquette or danger of premature fracture of briquette by further turning the hand wheel. The latest type of roller clips are used with these machines and in some cases compression-test tools are employed for testing 1-inch cubes. The transverse test-tools are arranged for 4 inches between supports, but any other desired length may readily be obtained. With these tools, the machine is equipped for coke, clay or glass tests, as well as all classes of cement tests.—*F. C. Perkins.*

Baling Oil Cans

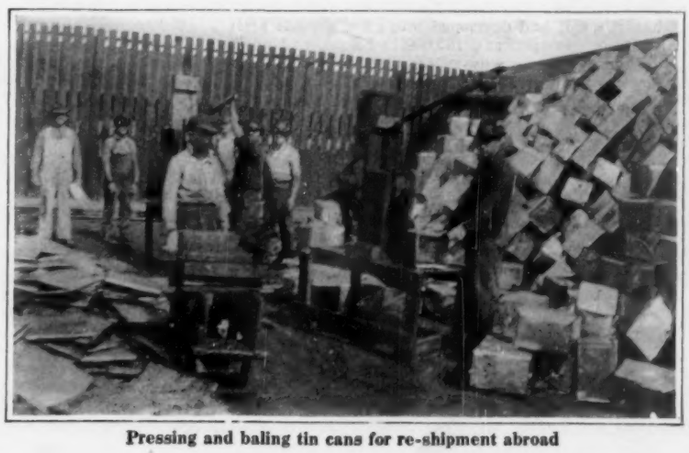
THE baling of vegetable oil containers and shipping them to Japan is a business that has developed to large proportions recently. The containers reach this country from Japan and other points in the far east filled with cocoanut oil and similar vegetable fats. After removal of their contents, it would be a good deal of a problem what to do with them, were it not for the fact that metal is scarce on the other side of the Pacific, and the oil shippers are glad to get them back to use over again. For economical shipment, however, since ocean rates are based as much on bulk as on weight, it is necessary that the cans be flattened out in some way. There are no machines for doing this work on the market but individuals in San Francisco have designed a number of special machines for the purpose which are a great improvement on the methods first employed.

After the cans have been emptied the ends are cut out and the cans pressed together and baled in bundles of 40 each. A V-shaped knife attached to a lever cuts the end around the sides at one movement as shown in one of the photographs. The end is then bent back into the can, and the other end is cut out. The can is then partly flattened out by hand and pressed out to a minimum this time in a second machine. They are then baled and bound together by wire or metal straps in bundles of 40. Power is obtained by a common railroad jack placed under wooden blocks on which the tins rest. By operating the hand lever the cans are forced into a compact bundle, and after fastening them with the wire or strap, the jack is released, and the baled cans are taken out and piled up ready for shipping.

During the war as high as $100 per ton was obtained for these baled cans. They are sent back to Japan and used over two or three times. Sometimes 120,000 of these cans accumulated in San Francisco. Railroads will not accept oil in these cans for shipment, and as a result all cans are emptied and pumped into tank cars at San Francisco for shipment east.—*C. W. Geiger.*



Machine for converting the bottom of a can into a flap preliminary to pressing and baling



Pressing and baling tin cans for re-shipment abroad

Copyright, Keystone View Co.

Twelve feet were sliced off this apartment house to widen the street

Adding to a Street by Subtracting from Buildings

IF the accompanying photograph were taken in Belgium or France, one would imagine that the war had passed this way and left its unmistakable imprint. But far from being the aftermath of military activities, the apartment house here pictured has had a slice taken from one side in order to widen one of New York's streets at the time when a new subway was being built. Nothing was permitted to stand in the way of the widening of the street. A line was drawn from one end of the street to the other, and everything protruding over that line was removed or torn down. As a result one sees many houses without yards, houses from which a slice has been taken, and houses whose sides have suddenly become fronts facing on the widened street. In the instance of the house shown, something like a 12-foot slice was taken off, and the owner has not bothered to finish off his buildings, thanks to the scarcity of housing facilities in New York City, which makes the tenants hold on whether a house is whole or not.

Bee-Farmer Uses Airplane

IN the stress of a seed-time or harvest emergency, farmers have had to pay unprecedented prices for labor, but none, so far as we have heard, has equalled Nelson W. Peck, of the Yakima Valley, Washington. Peck keeps bees—a lot of them. Fruit blossoms are an important source of nectar out in that country, and spray-poisoned orchards a lively menace to the bee-keeper. In fact, in 1918, Peck lost over 700 hives of bees from poisoning, a mighty big loss when we consider the depreciation in his investment together with the loss of potential profits. Honey prices were way up, so that every single efficient colony was a sizeable asset.

To prevent a repetition of poisoning losses in 1919, Mr. Peck employed expert labor at $1 a minute—$60 an hour. The expert was an aviator. Is Nelson W. Peck the first farmer in the United States to employ an aviator in his farming business?

On the first of several flights with the aviator, Peck was up seventy-five minutes. His object was to pick out stands for his bees sufficiently removed from spray-poisoned orchards to guarantee safety, and he could think of no way of doing this like observation from an airplane. To Peck, the cost of the service, $1 a minute, was a mere trifle, beside its value to him. He says he would have saved $10,000 in 1918 had he taken such a flight before setting his bees. The system followed by big beekeepers like Peck is to establish small yards at scattered points in a wide territory, as in this way only is it possible to keep many hundreds of colonies. As the honey bee seldom forages above two miles from the hive, it is practical to make locations from an airplane.

The Heavens in January, 1920

Comets and Solar Eruptions Furnish the News of the Month

By Professor Henry Norris Russell, Ph. D.

THE comets which were visible at the beginning of the winter are now all receding and growing steadily fainter. The Brorsen-Metcalf comet on January 1st will be about 150 million miles from the sun, and nearly 180 million from the earth, and visible only in fairly large telescopes. Being 30 degrees south of the celestial equator, and about 55 degrees west of the sun, it can only be well observed from stations in the southern hemisphere, on what for them are the summer mornings.

Metcalf's second comet, known also as 1919C, since it was the third discovered in that year, is also a far southern object, 33 degrees south of the equator, and some 30 degrees east of the sun. It too is invisible in our latitudes. It is 110 million miles from the sun on January 1st, and 180 million from the earth; but it should still be of about the eighth magnitude and visible in a small telescope.

The comet discovered by Sasaki turns out to be identical with Finlay's comet, which has a period of six years and eight months, and has been seen at several previous returns. This time it reached perihelion on October 15th—shortly before it was observed—and from that time onward it was receding. Early in November it was less than 20 million miles from the earth, but at the end of the year its distance will increase to nearly 60 million, and it will be less than one-tenth as bright as at the time of discovery.

Finally, the comet discovered at Nice at the end of October—about which there was at first a good deal of uncertainty, owing to the scantiness of the cabled information—turns out after all to be a return of Schaumasse's comet of 1911, which was observed at that time well enough to indicate that its period was slightly more than eight years. Its rediscovery adds one more to the list of comets belonging to Jupiter's family which have been observed at two or more returns, increasing the number of these to 19. It is chiefly noteworthy as having the longest period of all 19, exceeding the next in the list, Faye's comet, by more than seven months. In consequence of this its aphelion lies some 140 million miles outside Jupiter's orbit. Two other members of Jupiter's comet-family possess computed periods a few months longer; but neither of these has been seen since the year of its discovery.

At this return Schaumasse's comet is faint, of only the twelfth magnitude, and observable only in large telescopes. It is receding rapidly from the earth and sun, and at the end of the year will be fully 140 million miles from the latter, and 180 million miles from us.

The Solar Photographer

Of the general astronomical news of the past month, perhaps the most interesting item is a paper by Mr. Pettit of the Yerkes Observatory upon two remarkable solar prominences, photographed on May 29 and July 15, 1919. Though the first of these days was the date of the total eclipse the observations here recorded were made quite independently of this, with the spectrohelliograph—that remarkable instrument which isolates, from the flood of light that the sun sends out, any one desired kind at will, and photographs the sun and its surroundings with this alone. Using the K line in the violet, due to calcium vapor, the prominences, or huge clouds of luminous gas which appear here and there above the edge of the sun, may be photographed in great detail. Usually the prominences are "quiescent," maintaining their position and form roughly the same during the two or three days for which we can see them at one edge of the sun, and often reappearing two weeks later, when the sun's rotation has carried them to the opposite limb. But at times there are violent eruptions on the sun's surface, which hurl the luminous material to enormous heights; and two of these, of exceptional magnitude, have been caught by Mr. Pettit.

The first of the two prominences had existed, as a quiescent object with relatively little change, from March 22 or earlier to May 28. On the latter date it extended along the limb for fully forty degrees of its arc, or about 300,000 miles, and was some 60,000 miles high. These dimensions, though huge in comparison with terrestrial standards, are not unusual in a prominence. On the following morning, however, the prominence had changed into a great arch of luminous gas, 400,000 miles long and more than 120,000 high. During the next hour it broke loose from its roots at both ends and developed into an enormous cloud of the dimensions of the original prominence, which rose steadily as though repelled by the sun. Within the three hours following, this cloud, growing fainter and more broken in outline, rose from its initial height of about 150,000 miles to the enormous altitude of 480,000 miles above the sun's surface. At this point it was lost, owing to its growing faintness and an unfavorable thickening of the sky. The next day the great cloud was gone altogether, but the "roots" from which it had broken loose—two columns of luminous gas—remained in sight until August.

The second great prominence, unlike the first, had little to herald its coming. On July 14th it appeared as a low cloud, with no unusual feature. The next day it had developed into an enormous arch, 250,000 miles in span and 150,000 in height, and when first observed was already rising very rapidly. In less than an hour and a half it had ascended to a height of 450,000 miles and faded gradually out of sight.

Mighty Upheavals on the Sun

The long series of photographs of these two prominences, which were obtained at intervals of only a few minutes, enable a closer study of these great eruptions to be made than has heretofore been possible. One very remarkable result is that the vertical upward motion of the great clouds of gas appeared to be uniform for a considerable interval, and then to suffer a sudden impulse, after which the rise continued to be uniform but at a much more rapid rate than before. Four successive upward impulses were observed on May 29th, and only one on July 15th. The latter, however, was the most powerful, leaving the prominence with an ascending speed of 102 miles per second, while the greatest speed observed in the earlier prominence was 37 miles per second. Just before the prominence began to rise as a whole, the under side of the great cloud appeared to be compressed, and crowded up toward the overlying mass. At the same time some of the small luminous spots, nearer the sun's surface, showed rapid motions sideways and downward, toward a sunspot which lay at the edge of the sun—the greatest speed here being 80 miles per second.

It is very obvious that enormous forces must be at work in these solar eruptions; but as yet we are at a loss to comprehend their exact nature. The prominences do not fall back into the sun, as we might expect on account of its attraction; hence some force must be at work which counterbalances the sun's gravitation. This may very well be the pressure of light, which drives comets' tails away from the sun, and which would act strongly on the material of which the prominences are composed, since this absorbs light of the same kind that it gives off. But what the nature of the impulsive forces may be, which seem to strike the floating masses of gas, and drive them with blow on blow into ever more rapid ascent, we are still uncertain. These may be of an electrical nature; but until a greater amount of observational material is available we are hardly likely to solve the riddle.

At 11 o'clock: Jan. 7.
At 10½ o'clock: Jan. 14.
At 10 o'clock: Jan. 22.

At 9 o'clock: Feb. 6.
At 8½ o'clock: Feb. 14.
At 8 o'clock: Feb. 21

At 9½ o'clock: Jan. 29.

NIGHT SKY: JANUARY AND FEBRUARY

The Heavens

The familiar aspect of the January skies is illustrated in our map. The Milky Way stretches across the heavens in a great arch from northwest to southeast, passing overhead. Along its line we find successively Cepheus, Cassiopeia, Perseus, Auriga (overhead), Gemini, Orion and Canis Major. The western sky contains Andromeda, Aries and Taurus; the dull southwestern region, Eridanus and Cetus. Hydra is coming up in the southeast and Leo in the east, while the two Bears and the Dragon are low in the northeast and north.

The Planets

Mercury is a morning star this month, but poorly situated for observation, being very far south. On the 1st he rises at 6 A. M., and should be visible in the dawn. Later on he draws nearer the sun and is lost to view. Venus is a morning star, in Scorpio and Ophiuchus, rising at 4 A. M. on the 1st and at 4:55 on the 31st. She appears telescopically in the gibbous phase, like the moon a couple of days after the first quarter, and is far brighter than any other planet. On the morning of the 5th she passes between us and the eighth magnitude star known as Bordeaux Catalog Number 4649. The star will be concealed behind the planet from 6:23 to 6:28 A. M., Eastern Standard Time. Such an occultation of a star by a planet is a rare phenomenon, but unfortunately in this case the star is too faint to be seen, so near the planet, except in a large telescope.

Mars is in Virgo, and comes into quadrature with the sun on the 13th, at which time he rises about twenty minutes after midnight. He appears about as bright as the neighboring star Spica, but can be distinguished at once by his red color. At opposition in April he will be more than ten times as bright as on January 1st.

Jupiter is in Cancer and comes to opposition on February 2nd, so that he rises at 7:30 P. M. on January 1st and by the month's end is visible all night long. Saturn is in Leo, and rises at 8:45 P. M. in the middle of the month. Uranus is in Aquarius, and too low in the west at sunset to be observable. Neptune is in Cancer and approaching opposition, which comes on the last day of the month.

The moon is full at 4 P. M. on the 5th in her last quarter at 7 P. M. on the 12th, new at midnight on the 20th, and in her first quarter at 11 A. M. on the 28th. She is nearest the earth on the 4th, and farthest away on the 16th. During the month she passes near Neptune and Jupiter on the 7th, Saturn on the 9th, Mars on the 12th, Venus at 8 A. M. on the 17th, Mercury on the 20th and Uranus on the 23rd. The conjunction with Venus is close and an occultation is visible from points in tropical South America.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

An ingenious trap arrangement makes this coffee pot dripless

The Dripless Coffee Pot

EVERY housewife has a song to sing, whose theme is the frequency with which the clean table-cloth is soiled by the drops that drip from the spout of the coffee pot after pouring. In spite of every care this will happen with existing pots and pitchers.

A German inventor comes forward, however, with a patented spout that prevents the drip from reaching the cloth. It is equipped with an ingenious trap that infallibly catches the drop left behind on the spout, before it can run down on the cloth.

It will be realized that the drop that really gives trouble is not the one that falls clear from the spout—this can easily be guarded against. It is the one that slides off the spout and down the side of the pot that tries the housewife's patience. The trap which the inventor places in the path of this recalcitrant droplet is well shown in our photograph. The drop starts to slide down the front of the spout, as usual; but when it gets to the point **C** it meets a little flange running around the spout, which provides a channel to lead it around into a reservoir at the base of the spout. Here, in the depression **A**, it must stay until the pot is again tilted for pouring, when it slides down another channel on the top of the spout, and rejoins the main stream of liquid at B. This latter channel is sufficiently deep and narrow to make sure of confining the drop so that it cannot slip off sideways and escape the fate laid down for it.—*H. Herzberg.*

A New Departure in Pump Design

THE loss of prime, clogging, inadequate suction and other troubles usually experienced in operating the common designs of pumps appear to have been overcome by a new pump construction, especially designed for pumping cutting lubricants. It should prove to be of great value in machine shop practice.

The principal working parts consist of two rollers which rotate eccentrically in the pump chamber, the entire motion being rolling, thus eliminating all of the wear usually caused by the scraping of working parts against the pump chamber.

The pump is self-priming, requiring no valves, and may be used anywhere within 10 feet above the level of the liquid. This positive suction is not affected by aeration, as is the case with many other pumps. The tank from which the liquid is being pumped may become entirely emptied and the pump suck in air, but when the tank is refilled it will immediately prime and start pumping again.

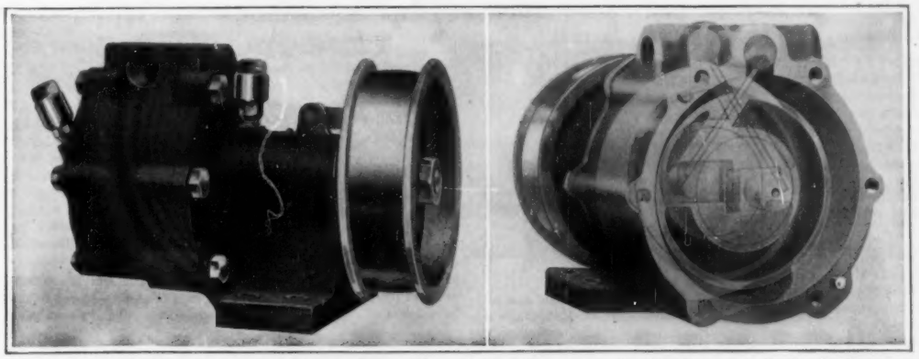
No relief valves or overflow piping are required. The outlet in the discharge piping may be closed and the pump allowed to run without damage to itself or the piping. This is accomplished by means of a spring placed in the rectangular slot in the inner roller, which bears against the squared shaft, and operates only when the pressure on the pump is as great as the pressure required to compress the spring. When this pressure is reached the compression of the spring allows the rollers to come to the center of the pump, where they continue to revolve in the liquid without exerting pressure on it.

The pump will not clog. Any particles, such as cast iron and steel chips, paper, etc., which can pass through the intake pipe can also pass through the pump without damaging it in any way. The action of the pump is to roll the liquid in front of the pump rotor, so that should anything stick, the spring will compress, allowing the roller to pass over the obstacle without damage, the foreign matter being washed out on the next revolution of the motor.

The pump action is universal and it may be used with either side up and at any point on a machine where its application is most convenient. The pump can be reversed without harming it, and will deliver liquid again immediately its proper direction of rotation is resumed. A pump equipped with reverse valves is used where it is necessary to maintain a constant flow in a given direction regardless of the direction of the rotation of the pulley.

Speed is not a factor in the efficient operation of the pump. It may be operated at speeds ranging from 100 to 600 revolutions per minute, making it applicable to all types of machines without the extra expense of making special provision for either high or low speeds in order to secure maximum efficiency. The fact that it may be operated at very low speeds insures long life where low speed can be obtained.—*S. R. Winter.*

Trimming rail-ends with the portable saw



Two views showing the construction and operation of the roller pump that is always ready for business

Portable Rail Sawing Machines

THE accompanying illustration shows a unique portable rail saw in service, as developed at St. Louis. These machines have been constructed for hand power and also motor-driven. The hand-power machine is provided with a saw blade 18 inches in diameter, while the thickness of the saw blade is 3/16 inch, and the maximum depth of cut measures 7¾ inches.

The weight of the hand-power machine is 350 pounds and the weight of the motor-driven machine is 450 pounds. This machine is designed to cut off rails at any angle with their length. The saw blade starts cutting in the center of the head of the rail, making a true vertical cut at any

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This bizarre bicycle has proved efficient for city use

Three ages of the bicycle—the latest type, the conventional bicycle and the old high wheel of the last generation

A Bicycle for City Use

SPECTATORS at the six-day bicycle race, in New York, this year, were astonished one day at the appearance on the track of a rider, peddling away on a machine whose wheels had apparently shrunk to the size of a small dinner plate. Vertically, however, the machine was not dwarfed, for the rider—and he was a tall man—sat or virtually stood upright, in strange contrast to the plodding six-day contestants. Despite the smallness of his wheels the new comer had no difficulty in

(Continued on page 654)

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Aeronautics

PROPELLER FOR AIRPLANES.—O. W. BOYEA, 9 W. Main St., Malone, N. Y. Among the principal objects which this invention has in view are, to vary the operating angle of the blades of an airplane propeller, to provide a mounting for holding the blades in operating position adapted to accommodate the independent movement of the blades, and to simplify the construction of the mounting.

AIRPLANE ENGINE MUFFLER.—F. J. HAUMAN, Bay Shore, N. Y. The invention relates to mufflers for reciprocating engines for airplanes, and has for its objects to provide a suitably shaped chamber open at its rear for the outlet of the exhaust gases, and having a plurality of fans rotatably mounted in the chamber at a point behind that where the exhaust pipe connects with the chamber, whereby to rotation of the fans draws off the exhaust gasses.

WING ARRANGEMENT FOR FLYING MACHINES CARRYING GREAT LOADS.—G. CASTAGNERIS, Rome, Italy. This invention relates to air craft with a supporting wing system comprising several wing columns each connected at its lower extremity with the car and each column having a plurality of biplane elements arranged vertically one above another, the distance between them being always greater than the interval separating any two planes of an element.

Pertaining to Apparel

NECKTIE FORM AND FASTENER.—C. C. JOHNSON, Box 242, Pawnee City, Neb. The general object of the invention is to provide a device to which the necktie may be permanently secured in a manner to cover and conceal the form, and to provide in connection therewith a clasp, whereby the tie when secured will have the desired artistic appearance as regards the form of the knot and the draping, and the neckband will be so disposed as to add to the artistic appearance by insuring a proper relation between the neckband and the remainder of the necktie.

HIP BRASSIERE ATTACHMENT FOR CORSETS.—FANNY C. MORSE, 980 Park Ave., New York, N. Y. The object of the invention is to provide a hip brassiere attachment arranged to overlie the corset at the back and hips below the waistline with a view to present a smooth foundation for the back of the outer garment to overlie, and thereby assuring a proper hang of the garment and an exceedingly close glove-like fit. The device may be readily attached to the corset by the owner.

HOSE SUPPORTER.—E. J. COTTUN, 687 Prospect Ave., Bronx, N. Y. Among the objects of the invention is to provide a hose supporter arranged to permit the user to readily connect and disengage the same. Another object is to securely grip and hold the hose without danger of tearing or otherwise injuring the hose material. Another object is to provide a supporter which is simple and durable in construction.

ATTACHMENT FOR GARMENT-POCKET.—O. D. BELL, 217 Fenimore St., Brooklyn, N. Y. The invention while serviceable in connection with garment pockets generally, is more particularly intended for use in connection with the pockets of fur garments. The general object is to provide means for reinforcing the pocket at the corners in such a manner that strain on the pocket will not be applied at the stitched corner but at points inward from the stitched corners, the reinforcing means serving to take up the strain applied to the pocket.

BELT.—W. A. SMITH, Box 2409, San Francisco, Cal. The invention has for its object the provision of a belt adapted for army, navy or civilian dress or money belt attachment, wherein a form of clasp is provided for connecting the ends, or for connecting bandoliers to the belt body, the said clasp being made in such manner that there are no points or exposed ends to catch in the clothing. The belt may be lengthened or shortened from the inside, there is no loose end outside.

Electrical Devices

DYNAMO ELECTRIC MACHINE.—E. A. WATSON, Coventry, England. The invention has for its object to construct a dynamo-electric machine for generation of low tension current for lighting and high tension current for ignition purposes, on vehicles driven by internal combustion engines, the machine being of the type in which there are combined with the generator field winding, an additional winding as a secondary of a high tension ignition system, and a contact mechanism for intermittently making and breaking the circuit of the field winding.

SEARCHLIGHT.—V. L. CACCESE, Box 524, Asbury Park, N. J. This invention relates to high power searchlights and has particular reference to the construction of such a device as contemplates not only maximum illumina.ing power, but also means to prevent damage due to excessive heat. In order to prevent overheating of the casing or reflector, the lamp bases and sockets are provided with extra large openings through the casing walls, to insure ample circulation of air.

Of Interest to Farmers

CORN PLANTER.—W. B. SHILLING, R. F. D., No. 4, Knox, Ind. The invention has for its object to provide a device of the character specified, adapted for use with cultivators, for replanting, wherein the planter is manually operated to drop the corn wherever desired, that is to say, wherever a hill is missing. The cultivator shovels will cover the corn dropped.

DRIVE MEANS FOR DITCHERS AND GRADERS.—F. O. SCHLUETER, address H. M. RIDDER, 5th and Main Sts., Fremont, Neb. The invention relates to a tractor-driven machine adapted for ditching, road grading and like work. The object is to provide in a machine of the indicated class, a drive means the general construction and arrangement of the elements in which are such as to result in a well-balanced and compact structure making for facility of operation and control.

CORN DRIER.—J. A. SCHARF, 142 S. Fulton St., Richwood, Ohio. The invention relates to a device for supporting ears of corn, to enable the corn to dry upon the cob, for preserving the same. An important object is the provision of a device

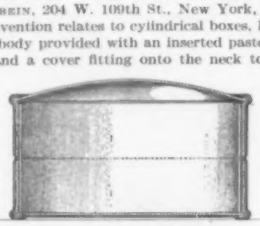
A SIDE ELEVATION OF THE DEVICE SHOWING PRONGS FOR RECEPTION OF COBS

which may be constructed in long sections to be wound upon spools for shipment, and which may be cut into suitable lengths for convenient use, the device being simple in construction and cheap to manufacture.

Of General Interest

SETTEE.—C. KRAMER, Rockaway Blvd, Stop 187, South Ozone Park, N. Y. An object of the invention is to provide a simple strong and inexpensive settee which can be easily and quickly transformed into a crib of fixed length, or a bed of adjustable length. The device has a foldable seat supported by seat extensions, with means for adjusting the relative positions of the end walls with the seat, whereby the length of the seat may be varied.

COMPOUND BOX OR CONTAINER.—H. HIRSHBEIN, 204 W. 109th St., New York, N. Y. The invention relates to cylindrical boxes, having a box body provided with an inserted pasteboard neck and a cover fitting onto the neck to close



A CROSS SECTION OF THE COMPOUND BOX OR CONTAINER

the box. The object is to provide a compound box preferably composed of sheet metal and paper and designed for containing medicines, pills, toilet preparations and the like. Another object is to provide a box which is exceedingly strong and cheap to manufacture.

TREE HOLDER.—J. KROLL, 88 Hadley St., Clifton, N. J. The aim of this invention is to provide a device with the aid of which a tree which has been sawed off adjacent its roots can be placed in such holder and held upright without any danger of the same toppling over. Although this invention is particularly applicable as a tree holder it may be used for holding upright any staff, such as a flagpole.

REGULATING DEVICE FOR THE FLOW OF LIQUID IN ORDNANCE BUFFERS.—E. RIMAILHO, Paris, France. The device constituting the object of this invention enables all the necessary variations of recoil to be obtained by substituting for the action of the single valve spring the simultaneous action of a second spring or elastic means, which produces in the buffer two different rates of working: the one with a low pressure with which long recoil is possible, the other with high pressure, where short recoil is indispensable.

PROCESS AND MEANS FOR CONNECTING CABLES OR WIRES.—R. A. BOUSSON, Paris, France. The invention relates to a process and means for connecting cables or wires. The device employed comprises a tube of suitable section in which the two ends of the cable or wire to be connected can be placed side by side, and the wall of which tube is provided with holes for the passage of one or more rivets designed to be introduced by force between the cables or wires.

SAFETY SWIMMING CYCLE.—A. H. JONES, 309 Winthrop St., Brooklyn, N. Y. Among the objects of the invention is to produce a device whereby a person may propel himself in or along the water. Another object is to provide a swimming device comprising a center ballast frame or floats, the buoyancy of which is sufficient to keep the machine afloat either with or without the swimmer thereon, and so designed as to give the swimmer's legs free movement either for auxiliary propelling, steering or support.

EMBALMING PROCESS.—T. B. BARNES, 24 W. 16th St., New York, N. Y. This invention relates to the embalming or preservation of corpses or flesh of bodies of inferior animals. Among the objects is to provide a more thorough distribution of the antiseptic or disinfectant fluid or fluids whereby the same may be caused to reach throughout the minutest portions of the body, and provide a more thorough desiccation of the skin, with natural preservative results.

METHOD FOR PRODUCING TRIMMED STEREOTYPE PLATES.—C. WINKLER, Berne, Switzerland. The object of the invention is to produce a make-ready for application to the back of a matrix, which consists in coloring the depressions and elevations of a print block, removing said color from the elevations of the surface while leaving it in the depressions, making an impression of said print block on a chalk mass, and in etching the parts of the impression not covered by color.

OIL TANK.—W. MACPHERSON, care Crescent Hotel, Tulsa, Okla. The object of the invention is to provide a tank wherein a floating cover is provided, adapted to rise and fall with the oil as it varies in level, to prevent the access of air to the surface of the oil and wherein the cover is provided with means for permitting the free passage of air outwardly and for preventing such passage inwardly toward the oil.

MASK.—J. A. DOBEY, Johnston, S. C. The invention has for its object to provide a mask of gauze adapted for use by doctors, nurses and the like, when in the presence of patients suffering from influenza, meningitis, and other diseases communicated through discharges from the nose and mouth. The device is of oblong shape, to fit over the nose and mouth, and is held in place by means of a cord passed over the back of the head.

SUSPENSORY.—C. H. GUILD, care Guild & Co., 235 W. 23d St., New York, N. Y. The object of the invention is to provide a suspensory arranged to permit the user to readily place it in position or remove it from the body and from a supporting belt without disturbing the position of the belt. Another object is to permit of readily disconnecting the textile material from the metal frame for washing purposes, and to insure a snug fit on the body.

Hardware and Tools

GAGE.—B. S. THOMPSON, 234 Griggs St., S. E., Grand Rapids, Mich. The invention relates to a device for use in the gaging of machine parts. The general object of the invention is to provide a tool having the advantages of the solid gage in the simplicity and facility of manipulation and the approximate advantages of the micrometric calipers in affording a wide range of adjustment.

CALKING TOOL.—L. PAULERO, Box 285, Petersburg, Va. The object of the invention is to provide a tool for calking the seams of vessels, so arranged as to be used in mechanical hammer, and having provisions for pressing the calking blade against the calking material with varying degrees of pressure. Another object is to provide a tool arranged to straddle the seam and having a funnel for guiding the calking material into the seam and beneath the tool.

SAW STRAIGHTENING ANVIL.—T. WEBB, 57 Cordova St., West, Vancouver, B. C. Canada. The invention relates particularly to anvils for straightening saws, and has for its object to provide a device of this character, adapted for use in straightening the cutting and raking teeth of saw, for facilitating the removal of dents and bumps from the saw and for straightening twists in the blade.

PIPE WRENCH.—W. L. BESSOLO, Keyler Grand Bldg., Walla Walla, Wash. The particular object of the invention is to provide a pipe wrench of that type which includes a shank and a flexible object—encircling jaw having an elongated link connecting the same at one end with the shank, the shank being provided with means with which the free end of the flexible jaw is adjustably engaged in order to hold the same in connection with the engaged object.

LATHE TOOL.—L. E. HUNT, 901 S. Campbell St., Springfield, Mo. The object of the invention is to provide a tool to replace the usual tailstock center in the tailstock of a turning lathe, for permitting the desired degree of taper to be obtained by the adjustment of the tool. The invention provides a holder in the form of a cross head, consisting of a body and central stem, the said stem being a standard lathe center shank.

LOCK NUT.—R. H. FEWSTER, Darkan, West Australia, Australia. The invention relates to means for securing and adjusting bolts and nuts on parts of machines. One of the objects is to allow the positioning and adjustment of nuts upon a bolt or bar without necessary contiguity to other fixed parts of the machine or permanent structure. Another object is to enable the tightness of the nut and bolt to be adjusted easily, effectively and to a fine degree.

Heating and Lighting

HEATER.—P. ROUGHEN, Fond du Lac, Wis. The invention relates to a heater of the sectional type, the heating of which depends on hot gas circulating therethrough. An object is to provide a simple heater which can be easily connected to a chimney or stovepipe to utilize the heat carried by the gases within the stovepipe or chimney before the gasses escape into the atmosphere.

Machines and Mechanical Devices

BINDER AND LINING HOLDER.—L. FEIGELMAN, 959 Jackson Ave., Bronx, N. Y. The invention relates to attachments for sewing machines and particularly to a binder and lining holder which will guide the binding and lining simultaneously so that a single line of stitching will connect all these parts. An object is to provide a guide for guiding a binder over a reinforcing and at the same time guiding a piece of lining so as to be stitched in place by the same line of stitching that connects the binding with the reinforcement.

PRINTING MACHINE HAVING OSCILLATING PRINTING CYLINDERS.—C. WINKLER, Berne, Switzerland. The invention relates to printing machines in which the impression cylinder is oscillated backward and forward over a reciprocating carriage carrying the form. By this invention an exact register is rendered possible in placing the sheets into the machine, further, smearing of the freshly printed sheets is avoided, and a reliable conveyance of the sheets is assured.

ROD BENDING MACHINE.—C. A. NELSON, Buenaventura, Columbia, S. A. The invention relates to a machine which will quickly and accurately bend a straight rod into the desired shape in one operation. A specific object is the provision of bending device for bending concrete reinforcing rods into various shapes, the structure being such that the bending jaws and associated parts thereof may be adjusted for different shapes and sizes without varying the action of the thrust means operating on the jaws.

MACHINE FOR MAKING ICE-CREAM CONES.—F. MANTELL, Connellsville, Pa. The invention relates to machines for making ice cream cones, and has for its object to provide a machine of the character specified into which the batter may be fed and which will separate the batter into cylindrical masses of the proper size for making an ice cream cone.

(Continued on page 644)

MEETING COMPETITION

The Motor Truck is an aggressive force in overcoming competition.

THE problem of competition, through the introduction of motor trucks into so many different kinds of business, has become greatly intensified.

Every business that, through efficient motorization, can haul goods more economically and rapidly, that can tap sources of supply independent of the railroads, that can meet transportation emergencies, will find competition increasingly easy to overcome. A case in point—

How SERVICE Trucks built up a business.

Quigley & Meeker, Youngstown, Ohio, four years ago, facing strong competition, met the situation by discarding horse drawn vehicles and replacing them with SERVICE Motor Trucks. The performance of their fleet of SERVICE Trucks—unfailing, dependable, powerful and economical and successfully competing with all opposition—has been a vital factor in building up their business, against strong competition, to the dominant position which it occupies today.

SERVICE Trucks are constructive carriers.

Firms that have not already efficiently motorized their business, will find themselves at a decided disadvantage.

SERVICE Motor Trucks have been designed to meet the broadest demands of aggressive business competition. In the every-day test, SERVICE Trucks are proving active *Builders of Business* for manufacturers, jobbers, merchants and farmers in all parts of the country.

These SERVICE owners wrote the composite endorsement—

The Dodd Warehouse, San Francisco.
Louisville Builders Supply Co.
Kothe, Wells & Bauer Co., Indianapolis.
A. McGee, Cincinnati.
Gardner Cartage Co., Cleveland.

The paragraph below is a composite endorsement by SERVICE Motor Truck owners:

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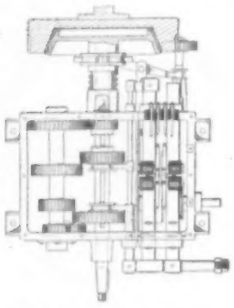
RECENTLY PATENTED INVENTIONS

(Continued from page 642)

ELECTRIC GEAR SHIFTING MECHANISM.—A. P. RIEDELE, 216 Fourth Ave., S. E. St. Cloud, Minn. An object of the invention is to provide a device which will prevent the stripping of the teeth of gears when the latter are shifted. A further object is to provide an electric



A PLAN VIEW, CERTAIN PARTS BEING SHOWN IN SECTION

device for shifting gears which may be set for certain speeds so that when the main clutch is thrown out and the load is taken off from the gears the latter will be shifted to produce the proper speed when the main clutch is again thrown in.

VENDING MACHINE.—F. M. HUME, 8964 118th Ave., Edmonton, Alberta, Canada. The object of the invention is to provide a machine especially adapted for vending packaged goods, wherein a plunger is provided for ejecting the package, and a coin released lock for preventing the movement of the plunger until released by the insertion of a coin, and a follower for moving the packages beneath the plunger operated by the movement of the plunger to advance the package.

OIL WELL PUMP.—R. B. THURSTON, Box 305, Oil Center, Cal. The invention more particularly relates to apparatus for actuating the plunger rod of oil well pumps, the object being the provision of means which will automatically permit of vertical creasing of the plunger of the pump in the plunger casing or working barrel, and in this way avoid certain disadvantages in operation to which pumps and their connections are subject.

MECHANISM FOR ROTATING EARTH-DRILL BITS.—W. NIPPERT, Vernon, Texas. The invention relates to mechanism for rotating drills in a cable rig in which a jig or up and down motion is given. An object is to provide a drilling mechanism in which the drilling operation will be performed solely by the weight of the drill stem. Another object is to provide mechanism which shall by rapid reciprocal rotation of the drill cause a round hole to be made, and to prevent packing up the walls of the well.

COMBINED SCREEN AND ELEVATOR.—E. E. CARPENTER, 3152 Lewiston Ave., Berkeley, Cal. The invention is especially intended for elevating and screening ores, the object being to provide a screen adapted to have delivered thereto the material from a tube mill or ball mill, or other grinding machine, and arranged to carry upwardly such of the material as shall not have been reduced sufficiently fine for further treatment, and whereby the coarse material may be returned to the mill or grinding machine.

ENGRAVING MACHINE.—B. R. CORLEY, care Turner Bros., 409 Pearl St., Brooklyn, N. Y. The object of the invention is to provide an attachment for an etching machine whereby the operator is enabled to accurately space letters, numerals, signs or other characters irrespective of their width and shape. In order to accomplish the result the work bed, carrying a coated plate, is mounted to slide sidewise under the engraving needle and a spacing device is connected with the work bed.

ADJUSTABLE SPIDER CHASE AND LOCKUP FOR PLATEN PRINTING PRESS.—E. KARL, 20 West Main St., Litchfield, Conn. The object of this invention is to eliminate furniture, quoins, and waste of time in locking up forms for printing. The device includes side bars comprising pairs of spaced members, upper and lower form bars mounted between the side bars, stay bars slidably mounted between the members of the spaced bars and adjustably engaging the outer edges of same, and adjustable locking means carried by the upper form bar, and engaging the opposite ends of the stay bar.

Musical Devices

INSTRUMENT ATTACHMENT FOR PIANOS.—D. CRINO, 116 First Ave., New York, N. Y. Among the objects of the invention are, to equip a player piano with auxiliary accent monotone instruments to install the auxiliary instruments in mechanically played musical instruments of usual make, to provide means for manually controlling the use of said auxiliary instruments, and to employ the instrumentality used for actuating the usual mechanically played musical instrument for at will playing auxiliary accent instruments.

Prime Movers and Their Accessories

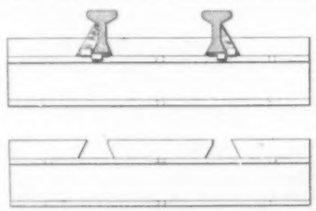
OSCILLATING PISTON ENGINE.—N. PAVIA and G. CASALIS, Turin, Italy. The invention has for its object to produce an engine which is compact, simple, inexpensive, and durable, and in which no residual of the burnt gases remains; the charge is pure and not so high in its temperature, not being mixed with residual gases; a long expansion is permitted; the distribution is made by the pistons without any valve or supplementary organs under control.

SUPERHEATING MANIFOLD.—J. G. LAWSHE, Flemington, N. J. The invention relates to internal combustion engines such as are used in automobiles and similar vehicles, its object is to provide a superheating manifold arranged to supplement the usual explosive mixture with a superheated charge of air or steam or both to enrich the explosive mixture and thus render the same more forceful.

DECARBONIZER AND GAS SAVER FOR INTERNAL COMBUSTION ENGINES.—M. PIERZCHALSKI, 423 W. 42d St., New York, N. Y. The invention has for its object the provision of an attachment for preventing deposit of carbon on the cylinders of an engine. A further object is an attachment for an internal combustion engine connected with the accelerator pedal for adding to the explosive mixture auxiliary air and steam or water in addition to the air supplied to the mixture by the carbureter.

Railways and Their Accessories

RAILWAY TIE AND FASTENER.—W. H. WILD, 1905 E. 10th St., McKeesport, Pa. One of the principal objects of the invention is to provide a rail fastening device in which keys are utilized in securing the rails in place, fasteners being employed for preventing displacement of



SHOWING SIDE ELEVATIONS OF THE TIES AND FASTENINGS

the keys. Another object is to provide a device which may be easily and quickly put in operation, the construction being such that the fasteners may be removed when desired to allow of replacement of the rails.

RAILWAY TIE.—J. R. DOOLEY, W. Hazel 5 S. Springneid Ave., Mobile, Ala. The invention has for its object to provide a tie and means for securing the rail thereto. The device combines a concrete tie section having an under-cut recess, a cushioning block secured in the recess having channeled sides, and rail-securing devices fitting in the channels of the sides of the cushioning blocks and having hooks to extend under the blocks and over the rail flanges.

Pertaining to Recreation

TOY BOAT.—O. E. WALL, Box 648, Honolulu, Territory of Hawaii. The invention has for its object to provide a toy boat of the submarine type wherein propelling mechanism is provided and approximately horizontal vanes or rubbers are provided for causing the boat to drive or rise in the water, wherein the propeller is spring controlled and the vanes are controlled by the same spring, when under tension holding the vanes in driving and when relaxed permitting them to move into rising position.

Food versus Feed

(Continued from page 632)

but even for this purpose it has not been successfully marketed in large quantities, because alone it lacks the finely divided fat which in cooking gives the milk a shortening value, and which enriches and makes more palatable the cooked or baked food product. The use of pure fat for shortening is not the best method of introducing this element into cooked foods, because it tends to soak in and mass the other ingredients. It has long been recognized that rich milk or cream is better for cooking because the fat in milk or cream is so finely divided that it mixes more readily and evenly than does pure fat, such as lard or cooking oils. Therefore, one of the essentials to the successful marketing of this great amount of now wasted food is the addition of fat.

Great advances have been made in recent years in food chemistry, particularly in the matter of developing vegetable-oils as substitutes for animal fat. Corn, cotton-seed, peanuts and many other vegetable products are now used for the manufacture of cooking oils, and cocoanuts have been found to make a superior grade of vegetable oil. Chemists have discovered a process by which the fat pressed from the clean white meat of the cocoanut and highly refined can be emulsified or combined with skimmed milk, thus restoring its food balance and value as a cooking ingredient. This combination, when condensed or evaporated and canned, will keep indefinitely, and can be used as a substitute for whole milk in all cooking operations.

Not long ago, in an effort to save some of the skimmed milk fed to stock and render it available for human food, the Department of Agriculture conducted a cottage cheese campaign, and under the direction of the home demonstrators throughout the country, taught the women of the dairying communities how to make and market cottage cheese. The campaign was quite a success, and in some communities the daily consumption of cottage cheese rose from a few hundred pounds to many thousands, and a great deal of the milk formerly thrown away was thus saved for cheese making. If this campaign of education can be continued, and the demand for cottage cheese and synthetic foods stimulated, our food resources would be very materially strengthened.

Nature's Geometric Workmen

(Continued from page 633)

been waged for more than a hundred years between the theorists and the microscopic investigators.

When the study of Polycystina had become a vogue—and it had a very large vogue in the early days—the regularity with which facsimiles of the ivory ball carving of John Chinaman was simulated in pure white transparent glass by certain species of these animals was confusing if not altogether puzzling to these early observers. Their literature always referred to the ivory balls in describing the beauties of Polycystina. But it was soon found that the animals had not confined themselves to producing the original ivory ball design alone, but had produced a multitude of forms; balls within disk-like boxes of the most beautiful lacy reticulated patterns; some with star-like projections, others with spear shaped spines, and still others with delicate spines with twisted flutings; indeed, there seemed no end to the fantastic notions of the various species. So aggravatingly interesting did this make the creatures that in a short time tons of Barbadian rock were distributed in small pebbles over the civilized globe for the ostensible purpose of study. Indeed, the island has since become the most densely populated island in the world, although human kind no longer have much interest in Polycystina.

It was not until the British sea-exploring ship "Challenger" brought home its deep-sea treasures that the microscopical world was again startled by a second appearance of Polycystina, this time represented by specimens of living forms but under the name of Radiolaria. So vast were these collections of the animals, that their classification, description and illustration occupied Professor Haeckel—with the assistance of other scientists and of illustrators—more than ten years. The result is three immense volumes, with 140 plates, showing 739 genera and 4,318 species, for this one report; while Haeckel assures us it would take a lifetime to work out in catalog-manner all of the forms of living Radiolaria.

Radiolaria, with their predecessors Polycystina, have, we see been honored by two separate investigations that have brought each into the limelight of popular interest. And, although it is true that other groups of microscopic animals and plants have had their vogues, it is also true that Radiolaria are as universally popular with all classes of observers today as they have ever been. The extreme beauty of the Barbadian group made them in the early days, when the microscope was less perfected than it is now, easily the most popular of microscopic fossils. So was it with the investigations of Haeckel, spurred on by the study of our Alexander Agassiz, resulting in the voluminous report for the "Challenger." More than this Haeckel places this group among the highest of the protozoa, of which it is a class, and therefore gives to it racial supremacy. Observers, nevertheless, have been primarily interested in the startling magnificence of their skeletons, later by a vague though none the less drawing attraction which is not at first easy to explain.

During the making of the drawings for the Haeckel investigations something of this mysterious attraction was made clear, that is, it was evident to the draughtsman, who consciously or unconsciously developed exceptional skill in the execution of graceful geometric forms. The copying of the skeleton was bringing forward his greatest talents. Beginning as a noted and exceptional draughtsman—and none but an exceptional man can draw these beautiful forms satisfactorily—he was forced to excel himself. Here before him was an endless aggregation of geometrical combinations, more perfect, more insinuatingly complex, more interestingly attractive than any group that he had been called upon to illustrate. Nature had provided these animals with a faculty to fashion their skeletons with perfect geometric precision. How? That was the question. It is a tribal characteristic. Why? Here lay the crux of interest in these animals for all studious observers, and the draughtsman of the 140 plates for the "Challenger" Report came nearer to understanding its pulling mystery than any other man.

How to Get the Most Out of a Motor Truck

(Continued from page 634)

operating the truck should familiarize himself with these points where slight friction comes, and see that they receive the attention which they require as the number of such bearing points vary with all trucks.

It is essential for the proper care and maintenance of any truck that the following maintenance routine schedule be adhered to, with such modifications as the truck design demands. Preparedness for emergencies can only be obtained by keeping the truck in excellent condition, and this necessitates proper adjustment at regular intervals of time.

Daily Routine

Engine: Examine all wiring terminals for tightness. Clean magneto externally.

(Continued on page 646)

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MOTOR TRUCKS

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The nameplate on a truck is a very practical form of insurance. It affirms that every dollar of the investment is protected by a company that has never failed to meet its obligations.

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How to Get the Most Out of a Motor Truck

(Continued from page 644)

Note tension of fan belt. Inspect oil supply in engine crank case. Inspect oil pump for performing its proper function. Inspect radiator-water supply. Inspect loose connections for leaks. Inspect gasoline tanks for proper fuel supply. Inspect fuel pipe line and all connections for leaks.

Inspect the *brakes* for undue wear or looseness and tighten if necessary. Inspect for proper operation. *General*: Inspect and thoroughly clean all lamps. Fill and clean acetylene generator or fill kerosene lamps if electric lighting is not used. Inspect tires for air pressure, cuts or damage if of the pneumatic type. Tighten all loose bolts and nuts.

Weekly Routine

Engine: Inspect all wires for proper support and freedom from damage. Thoroughly clean engine externally. Inspect oil pump connections for oil leaks. Inspect all water connections for leaks. Inspect carburetor control connections. Do not attempt to alter carburetor adjustment unless this is shown to be necessary when the truck is in service.

Remove magneto distributor cover and clean with gasoline and clean cloth. Operate engine at low speed and, with one wire at a time separated from spark plug, inspect the spark given for length and apparent hotness. Keep engine free from carbon; inject tablespoonful of kerosene into each cylinder, through pet-cock or spark-plug holes. This should be injected when the motor is hot and allowed to stand over night. Remove, clean and adjust all spark plugs.

Inspect and thoroughly clean and oil all brake connections. Adjust if necessary. Inspect center bolt of spring and spring clips for apparent tightness. Inspect front wheels for alinement with rear wheels. Inspect tires for undue damage and wear. Jack wheels up and inspect bearing adjustment. Inspect spindles and spindle bolts. Inspect tie rod adjustment. Inspect entire clutch mechanism. Clean and inspect all transmission control connections. Inspect universal joint for undue looseness and wear. Clean and refill universal joint with grease. Inspect differential and propeller-shaft bearing adjustment. Inspect body bolts, hood fasteners and all similar bolts for apparent tightness. Inspect tool equipment for completeness.

Monthly Routine

Engine: Determine if carbon is present in quantity in the engine. Examine and inspect engine for loose parts, leaks, noises. Clean oil pump screen. Grind valves if necessary. Clean magneto collector ring, polish and adjust breaker points. Inspect magneto to cam for correct advance.

Inspect clutch hub grease tube. Inspect clutch operation. Inspect clutch alinement. Clean transmission externally and inspect for leaks, particularly the drain plug and the rear bearing. Thoroughly inspect and clean spring shackle connections. Inspect springs to ascertain damage if any.

Clean and inspect differential housing for oil leaks. Inspect brake arms and equalizers on differential housing. Remove wheel hub caps and inspect for proper lubrication. Determine condition of bearings. Look over universal joint ring and yokes. Inspect housing bolts inside universal joint housing. Inspect transmission arm bolts. Look over front motor support bolts. Inspect oil pan and transmission bolts. Inspect steering gear for lost motion and lubrication. Inspect speedometer drive.

Care of Springs Important

See that the spring shackles are free and do not bind with the nuts. Also keep them well lubricated, for dry shackles

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WALTHAM

THE WORLD'S WATCH OVER TIME

How to Get the Most Out of a Motor Truck

(*Continued from page 646*)

tend to permit the upper leaf—the only one fastened to the shackle—to bulge out of shape—this will break the leaf almost every time. The spring clips must be tight. The duty of the clips is to keep the various leaves together—if loose, they cannot do their duty—keep them tightened. If loose, the leaves are permitted to spring apart and they are apt to snap off at the center bolt. Loose clips also permit the leaves to shift forward or backward. This is especially true with the front spring. The shock is transmitted through the axle connection at the center bolt. If the clips are loose, the lower leaf will shift forward with the axle, while the upper leaf will remain steady with the load, consequently, the center bolt snaps off or gets badly twisted between leaves.

The importance of the center bolt has already been mentioned. This bolt must be kept perfectly tight or the leaves will shift as shown. Should this get broken on account of any of the conditions previously described, remove at once and replace with a new bolt. It is stated that many springs are broken because of lack of lubrication. The shackle must be well lubricated. The leaves should never be permitted to become dry. Summarizing the above, always lubricate at shackles and between leaves; keep shackles free—do not permit them to bind by screwing nuts too tightly; see that the spring clips are tight; keep center bolts tight and replace if broken; go over bumps easily, dodge all possible; drive slowly over rough roads, and do not OVERLOAD.

Rules of Reason for Drivers

Lubricate regularly and thoroughly; it prolongs the life of all trucks. Don't lock the brakes, thus sliding the wheels as it wears out tires and puts useless strain on the truck. Keep your truck and its mechanism clean. Grit is to wearing parts what disease is to the human race. Don't accelerate too quickly; it causes the motor to pound and puts needless strain on the truck in general. Keep the brakes adjusted. "Safety First," while a good motto for all, is doubly applicable as regards the operation of a truck. Don't allow the truck to stand in pools of oil or water; money saved on tires has as much purchasing power as that which is earned otherwise. Your employer knows this. Inspect and tighten up all parts of the mechanism often; it is unnecessary to quote the old adage in reference to "a stitch in time," etc. Change gears whenever necessary; they are put in the truck to avoid undue wear and tear; do your part.

Don't fail to cover the radiator and hood when truck is required to stand in cold weather; the purchase of a new motor, radiator and pump made necessary by a driver's carelessness will not tend to boost his stock with the employer. Have patience in starting the motor on a cold morning; it will not reach its highest efficiency until it warms up, so run it slowly for about five minutes before starting out. Find out what is causing any trouble that may develop and take means to eliminate it. Exercise thoughtfulness in picking the route; care in this regard will be compensated for by the extra good service which the truck will render. Don't speed; you are driving a heavy constant duty truck, not a racing car. Keep the truck moving: when running it is an asset, when standing, a liability. Don't overload; overloaded trucks, like overworked men, break down. Both are of very little value in that condition.

When Truck is Running

Any unusual noise is a sign that something needs attention. If car starts to skid, release clutch, but do not apply

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How to Get the Most Out of a Motor Truck

(Continued from page 648)

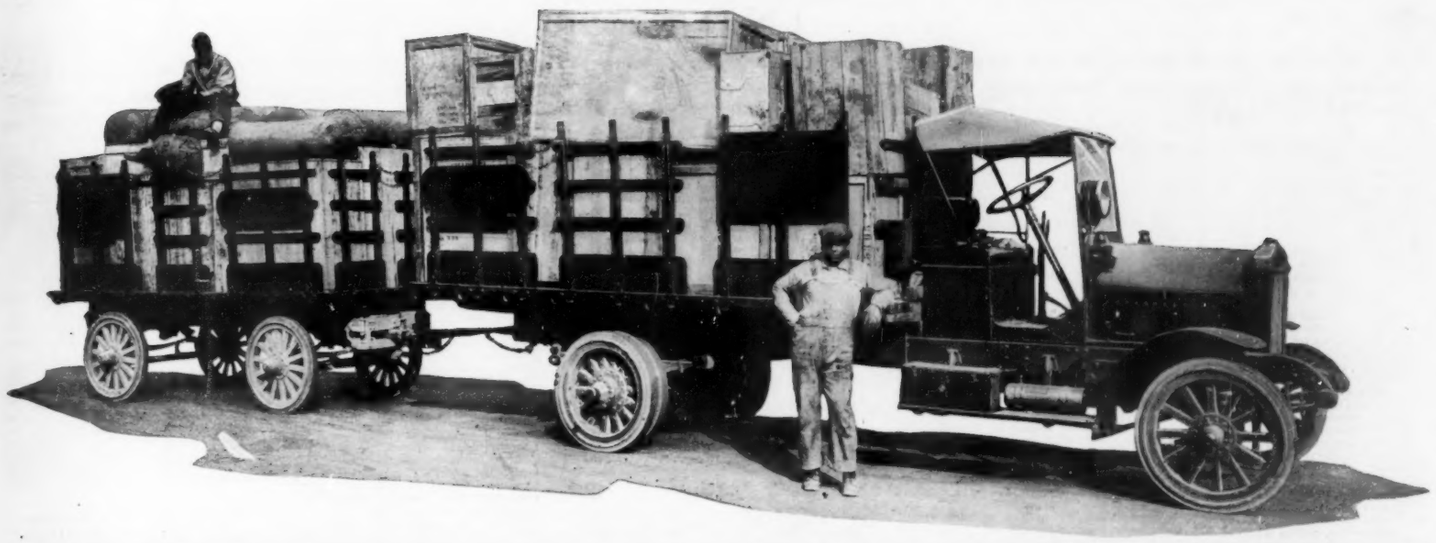
brakes until car is under control. Using a poor oil or oil that has been used too long in the engine will foul spark plugs. If truck is to be laid up for several weeks, put two tablespoonfuls of oil in each cylinder to prevent rust. Should it become necessary to tow another vehicle or to have the truck towed, be sure that the tow line is hitched to a frame and NOT TO AN AXLE. Always run slowly on wet asphalt and slow down for corners to avoid skidding and to save tires. Do not apply the brakes suddenly except in cases of emergency. Do not engage clutch when brake is set unless gear lever is in neutral. Do not start motor unless gear lever is in neutral position. Do not allow the truck to stand for more than a few minutes with the engine running. If the motor misses ignition the trouble is most certain to be in the spark plugs or wiring. Never run the motor at high speed without a load. If the motor has been overloaded so that the water has boiled away, raise the hood and allow it to cool down to normal temperature BEFORE ADDING MORE WATER.

Operating Trucks on the Road

Do not attempt to rush a hill. Shift gears when necessary to prevent unnecessary laboring of the engine, as the hill will be negotiated in less time and the strain on the mechanism will be relieved. If spark control lever is retarded, be sure to advance it after the grade has been negotiated, as running with a retarded spark will cause engine to overheat. To maintain control of the truck in descending long hills it is advisable to shift to second or first speed and cut off the ignition, using engine as a brake. With the emergency brake and the powerful service brake applied at the proper time to prevent truck gaining momentum, absolute control is assured. When truck is allowed to stand on grades, set the emergency brakes. Should the grade be particularly steep or the truck is to be left in this position for an extended period, take the extra precaution of blocking the wheels. When the truck is descending a hill, never attempt to retard its motion by using the reverse gear.

When chuck holes, raised crossings or ridges are encountered, allow the truck to enter the depression slowly, releasing the clutch momentarily and open the throttle just before the front wheels meet the rise. The front wheels will climb these abrupt ridges, so it is absolutely unnecessary to rush the hole to force the front wheels over. Careful handling under such road conditions will prevent undue strain on the springs, which bear the brunt of these sudden shocks. The same precautions used in climbing hills are applicable to the negotiation of soft roads of mud, sand or snow. Shift to lower gears before engine begins to labor. This is altogether desirable to prevent overheating of the engine. It is possible, when a four-wheel drive truck is mired in soft roadbed, to secure additonal traction by turning the front wheels so that they will work against the slides of the rut. With the means of securing additional traction and controlling application of power to all the wheels provided in that construction, it remains only for the judgment and ability of the driver to meet the special conditions encountered.

When starting through soft spots, do not race the engine before engaging the clutch, for the governor automatically closes the butterfly valve in the inlet manifold, consequently when the clutch is engaged the motor meets the peak load with small throttle opening. When starting against great road resistance, open the throttle gradually as the clutch is engaged. This will allow the engine to obtain its full charge of fuel at the moment when greatest power is needed.



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HEAVY DUTY TRUCK TRAILERS

TWO AND FOUR WHEEL TYPES

INDEX

Note.—Illustrated articles are marked with an asterisk (*). Look for the general subject rather than the supposed specific title of any article. Thus: "Aeronautics," "Automobiles," Meteorology," "Panama Canal," etc., will give related articles much more quickly than by reference to the article.

(Continued on page 654)

The Tendency of Truck Design for 1920

(Continued from page 636)

designers favoring detachable cylinder heads which promote accessibility of valves and piston for removing carbon deposits. The four-cylinder engine is standard, the trucks up to 1½ tons' capacity being fitted with an average of 20 horse-power, the cylinder dimension being about 3½-inch bore by 5-inch stroke. Two and 2½-ton trucks average 25 horse-power with cylinder dimensions about 4-inch bore by 5¼-inch stroke. Trucks of 7,000 pounds' capacity have engines averaging 32 horse-power with bore of 4¼ inches and stroke of 5½ inches. The heavier vehicles average 40 horse-power, with engines about 5 inches bore and 6-inch stroke.

Cooling is nearly always by pump circulation with a finned tube, cast shell radiator except on trucks based on passenger car designs which use honeycomb coolers and pressed metal shells. Practically all trucks of over 1 ton capacity employ magneto ignition. Oiling of the engine is by positive force feed by mechanically driven pump, the constant circulation system being general, the oil being forced through the engine bearings by pressure which increases automatically as the engine needs more oil.

An Increasing Use of Self-Starters Noted

To prepare for the growing demand for electric starting systems, many makers have made the first step incidental to furnishing a complete system by using electric lights. As this equipment calls for a storage battery and generator, which are the two most delicate main units in any system, there does not seem to be any good reason for leaving off the starting motor and switch which have always been of substantial and simple construction except their added cost. While their use is more general and in fact demanded more by users of light and medium weight trucks, one finds fifteen 7,000-pound models equipped with electric lights and twenty models of 10,000 pounds' capacity. In the 3,000-pound class, nearly 50 per cent of the ninety models may be obtained with electric starting and lighting. In the classification ranging from 4,000 to 5,000 pounds' capacity we find that 54 models may be obtained with electrical systems of which number 14 are so equipped when sold, the others being supplied only on order. There is a definite trend toward a complete electrical equipment, however, which truck makers are not disposed to ignore.

Hot Spot Manifolds Now Necessary

Another point that is receiving the attention of designers in connection with the power plant is the provision of manifolds having a heated portion or "hot spot" as it is called to facilitate the vaporization of the grades of fuel now being marketed. Ordinary gasoline of today contains fractions of low vitality and unless some provisions are made for assisting in vaporizing these fractions by a hot plate heated by the exhaust gas against which the mixture impinges, there will be considerable condensation and a resulting attenuation of the oil viscosity in the sump because of the dilution of the lubricant by unconsumed liquid fuel. This reaches the sump by leaking past the piston rings after the engine has become cool and the fuel condenses. A hot spot manifold was used advantageously on the Liberty truck and is now incorporated in many truck engines as a concession to the low grade fuel supplied the trade which will not improve in quality in the future. Several of the truck makers are fitting thermostats to control the engine temperature by keeping the cooling water at a reasonably high temperature and prevent overcooling which also assists in more complete utilization of fuels of low volatility.

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Houses Built on Sand

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working chamber were constructed. Inside, the minimum height of a working chamber was about 5 feet. Exteriorly, the side wall of the working chamber had vertical surfaces, but on the interior the surfaces all inclined towards the center, from the bottom up.

The several caissons were provided with a steel tubular shaft, 3 feet in diameter. This was located amidships and extended upwards from the roof of the working chamber. It is a necessary adjunct to the pneumatic caisson. The caissons were, of course, built up, section by section, from the roof of the working chamber.

The eight big caissons were sunk, little by little, with the aid of compresed air. There were several pipe connections to each, one for high-pressure air and the other for low-pressure. In addition there were the air-vent, the electric-transmission, and the water-pressure pipes. On the exterior end of a caisson, two timbers were arranged vertically to serve as guides.

The sealing of the spaces between caissons had to be done in a most thorough manner, as the success of the whole cofferdam, both during construction and later, largely depended upon this work. The vertical timbers serving as guides were 8 x 8 inches in cross-section. About 2 inches was the depth of insertion into one caisson. The next caisson simply abutted against them. This left an interval between caissons of about 6 inches. Between the two timbers, this interval was ultimately filled with clay. That is, clay was rammed into this space by means of a ram, vertically operated by means of a pile driver. On the side next the excavation, there was a 6-inch interval, extending from the nearby timber to the exterior limit of the caissons.

A Bicycle for City Use

(Continued from page 641)

holding his own with the racers who were grinding out the laps at a pace of about twenty miles per hour. Only at the turns did he have any trouble. The banks were too steep for the pace at which the machines were traveling. Even the full-sized bicycles exhibited a tendency to skid down hill and the new machine slipped so badly that the rider was obliged to keep to the level part of the track, at the inside of the curve. Nevertheless he circled around for a full mile close to the pack of contestants who were unaware of the strangely distorted wheel that was trailing them.

The rider of this odd bicycle was Mr. C. H. Clark, who invented the machine, not for racing puposes nor as a circus freak, but for real practical everyday service.

Recently, Mr. Clark called at the offices of the SCIENTIFIC AMERICAN and invited the editor to have a ride.

"Why have you built such a curious wheel?" he was asked. "What advantages does it possess over the ordinary bicycle?"

"Here is the answer," replied the inventor, pointing to his machine. "I did not have to leave the wheel at the curb and invite you down to the street to see it. I brought the machine up with me, not in the freight lift, but in a crowded passenger elevator, and neither the starter nor the operator offered the slightest objection."

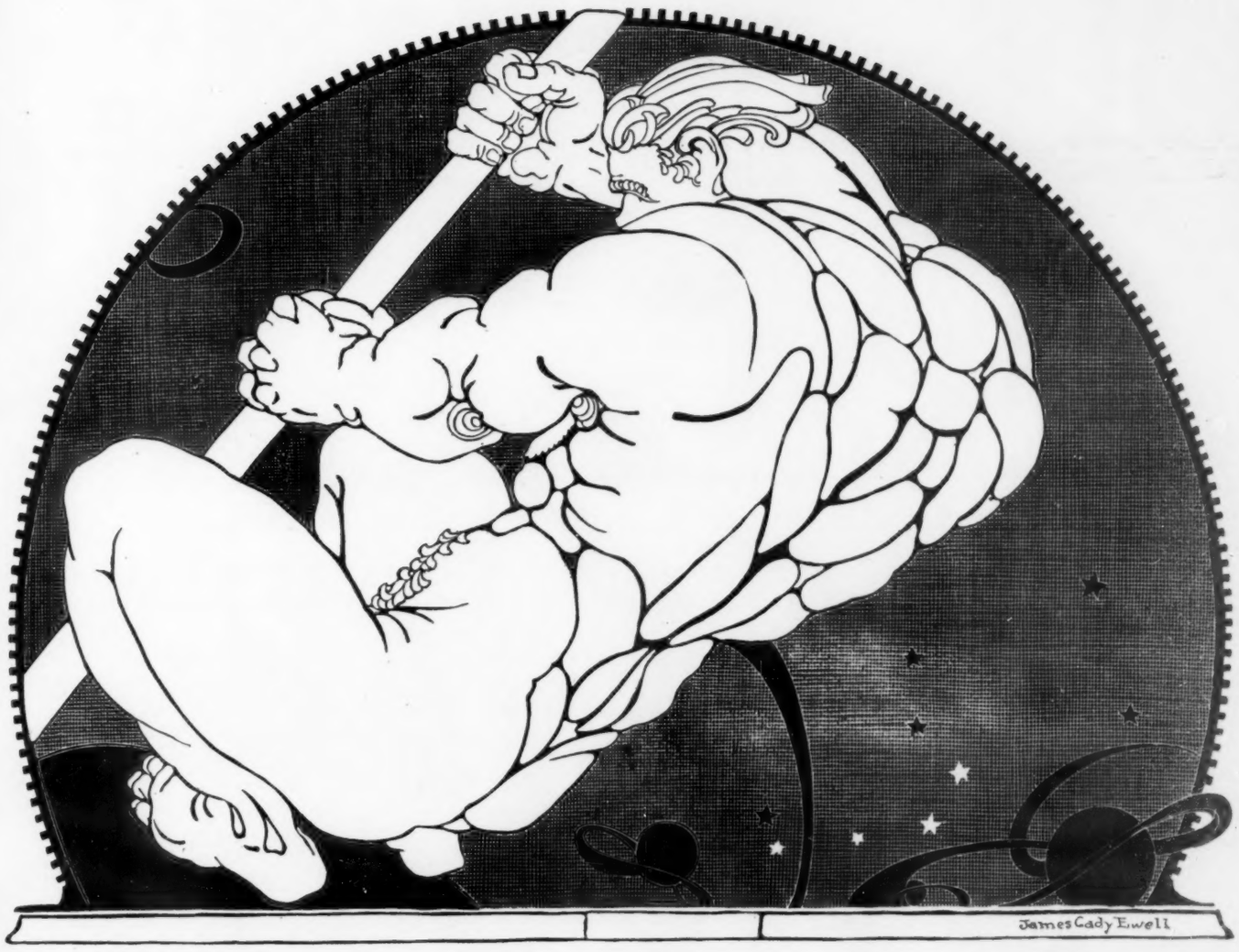
That tells the story. It is a city man's machinne. It will run easily on paved streets and even on smooth country highways.

Portable Rail Sawing Machines

(Continued from page 641)

angle, leaving the ends of the rail perfectly smooth and straight. The reducing gear is mounted on the slide, supporting the saw blade. The automatic feed lowers the saw at the proper speed for cutting through the head or base of the rail. A friction nut on the feed screw can be quickly released to feed the saw by hand through the web of the rail or in the return of the slide by means of a feed screw crank.

The saw blade is driven by an adjustable steel sprocket engaging the periphery of the saw blade, insuring a positive feed. The greatest possible capacity is thus obtained from both new and recut saw blades. Our photograph shows the small nut necessary to hold the saw blade on its arbor, no large driving collar being necessary which would tend to reduce the blade capacity. The steel sprocket is adjustable to care for worn or recut blades.—*F. O. Perkins.*



LEVERAGE

—the cosmic force by which Archimedes declared he could move the earth from its orbit is the principle employed in the Clark Internal Gear Drive Axle which gives it such herculean power—it drives near the rim.

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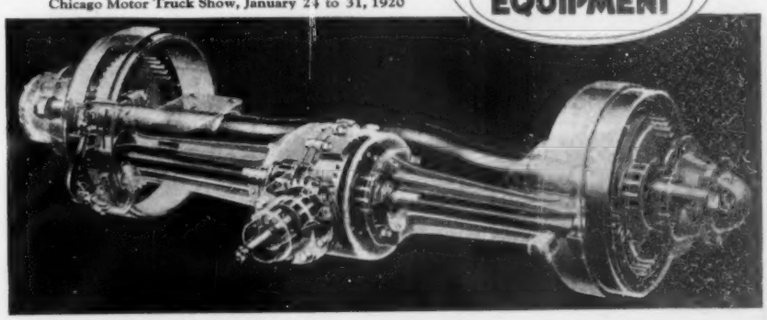

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